HORSELESS AGE The oldest automotive paper published in the English language has been purchased by The Class Journal Co. Its maintenance features, and a part of its circulation, have been merged with MOTOR AGE

MOTOR AGE

GENERAL LIBRARY
JAN 10 1919
UNIV. OF MICH.

Volume XXXV
Number 2

PUBLISHED WEEKLY AT THE MALLERS BUILDING
CHICAGO, JANUARY 9, 1919

Fifteen Cents a Copy
Three Dollars a Year

Champion
Dependable Spark Plugs

Champion
Heavy Stone
Price $1.25

Avoid Substitutes Look for "Champion" on the Porcelain

IT IS EASY to find the spark plug that is more *profitable* for the dealer to handle and also gives the consumer better *service*—simply look for the name "Champion" *on the porcelain.*

Experienced dealers know that to point to the name "Champion" on the porcelain is their best selling argument. It makes sales easy because consumers then know the dealer is not trying to unload a substitute plug upon them.

A complete stock of Champion Spark Plugs (there is one for every type of engine) means a bigger, steadier business for the dealer without wasted selling effort.

Champion Spark Plug Company
Toledo, Ohio
Champion Spark Plug Co. of Canada, Limited, Windsor, Ont.

Entered as second-class matter Sept. 19, 1899, at the post-office at Chicago, Ill., under Act of March 3, 1879.

JOHNSON'S
FREEZE-PROOF

is easy to use—is non-inflammable—inexpensive and guaranteed. It does not evaporate, so one application will last all winter.

Read This Guarantee

We guarantee that Johnson's Freeze-Proof has no more effect than water on the metals of the radiator or on rubber.

If Johnson's Freeze-Proof is used according to the simple directions in the proportion shown on our scale it will absolutely protect your radiator against damage from freezing.

We do not guarantee Johnson's Freeze-Proof when used in cars with aluminum manifolds, although it has been used satisfactorily in hundreds of such cars. Water alone often has an injurious effect on aluminum.

Testimonials!

I have used Johnson's Freeze-Proof in my Ford car all of this unusual cold winter with complete satisfactory results.—DR. WM. F. HAKE, Grand Rapids, Mich.

For saving me the price of an engine, I am indeed grateful to Freeze-Proof.—A. T. RICE, Crawfordsville, Ind.

I used Johnson's Freeze-Proof last winter and had no trouble.—L. K. LOY, St. Louis, Mo.

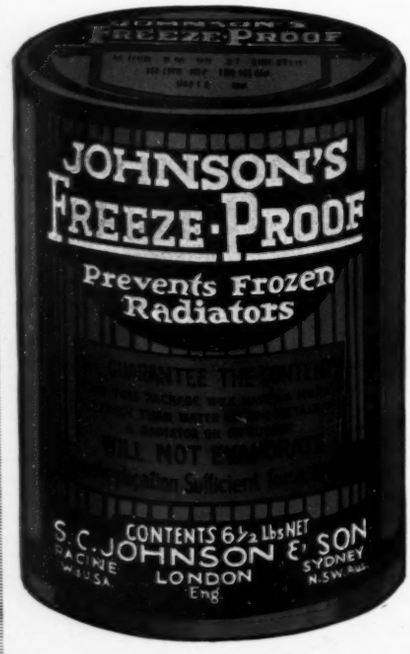
I have used Johnson's Freeze-Proof in my Overland car all winter and have had absolutely no trouble. I have no hesitancy in recommending Johnson's Freeze-Proof.—J. VAN NORMAN, Asst. Business Manager, The Herald, Grand Rapids, Mich.

I am glad to say that among the many things I have tried I found your Freeze-Proof solution the only one that did the work.—ALFRED HILL, DANVILLE, ILL.

Johnson's Freeze-Proof is the best insurance one can have on the cooling system of any car.—C. W. MALLORY, Georgetown, Ky.

I used Johnson's Freeze-Proof and it stood the test.—H. E. GNADT, General Hardware, Chicago, Ill.

We have recently had temperature of 20 below zero and it did not freeze in my car at that time.—W. J. DYSART, Woods-Evert Stove Co., Springfield, Mo.



Directions Must Be Followed

Johnson's Freeze-Proof will give perfect satisfaction if used according to directions on label. It requires just a little time and care to comply with these instructions—then your worry is over for the whole winter.

1st—Clean all dirt, scale, sediment, etc., from the cooling system by using a boiling solution of ordinary washing soda. Flush out thoroughly.

2nd—Repair all leaks. Unless hose connections are new, replace them. Tighten all packing and gaskets.

$1.50 Protects a Ford

One package of Johnson's Freeze-Proof (Cost $1.50) will protect a **Ford** to 5° below zero, and two packages to 50° below zero. For larger radiators or to protect to a lower temperature, use additional Freeze-Proof according to the scale on the package.

Your dealer has a Freeze-Proofometer and will be glad to occasionally test the protective strength of your Freeze-Proof radiator solution. This eliminates all doubt.

FOR SALE BY ALL DEALERS

Mfd. by S. C. JOHNSON & SON, RACINE, WIS.

MOTOR AGE

Published Every Thursday by

THE CLASS JOURNAL COMPANY

MALLERS BUILDING
59 E. Madison St., CHICAGO

HORACE M. SWETLAND, *Pres.* W. I. RALPH, *Vice-Pres.*
E. M. COREY, *Treas.* A. B. SWETLAND, *Gen. Mgr.*

MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

Vol. XXXV Chicago, January 9, 1919 No. 2

CONTENTS

Copyright 1918 by THE CLASS JOURNAL COMPANY

M. T. C. in France..... 7
N. A. D. A. Annual Meeting..... 9
New Laws Proposed.....10-11
Editorial 12
Makers Should Back Shows—Road-Building as Reconstruction — Demand on American Makers — The M. T. C. Overseas
U. S. Buys More Tires..... 14
First Foreign Post-War Show..... 15
Ford Two-Man Truck..... 16
Ignition on Liberty Engine..... 20
Electrical Equipment 22
Alco Farm-Lighting Plant..... 25
Truck Specification Tables..... 28
Titan 10-20 Tractor..... 38
Maintenance Data Sheet..... 40
Wiring Diagram Chart..... 45

DEPARTMENTS

Motor Car Repair Shop..... 26
Readers' Clearing House..... 32
Service Equipment 42
Accessory Corner 43
Among the Makers and Dealers..... 44
From the Four Winds 46

Adertisers Index—Next to Last Page

MOTOR AGE

MALLERS BUILDING Phone Randolph 6960
CHICAGO

E. E. HAIGHT, Manager
DAVID BEECROFT, Directing Editor
DARWIN S. HATCH, Managing Editor

BRANCH OFFICES

DETROIT, 95 Fort St., W. Phone Main 1351
CLEVELAND, 536-540 Guardian Bldg. Phone Main 1142
NEW YORK CITY, U. P. C. Bldg., 231-241 W. 39th St. Phone Bryant 8760

SUBSCRIPTION RATES

United States, Mexico and U. S. Possessions..$3.00 per year
Canada ..... 5.00 per year
All Other Countries in Postal Union..... 6.00 per year
Single Copies .....15 cents

Entered as second-class matter, September 19, 1899, at the Post Office, Chicago, Illinois, under Act of March 3, 1879.

Owned by UNITED PUBLISHERS CORPORATION, 243 W. 39th St., New York, H. M. Swetland, Pres.; Charles S. Phillips, Vice-Pres.; W. H. Taylor, Treas.; A. C. Pearson, Secretary.

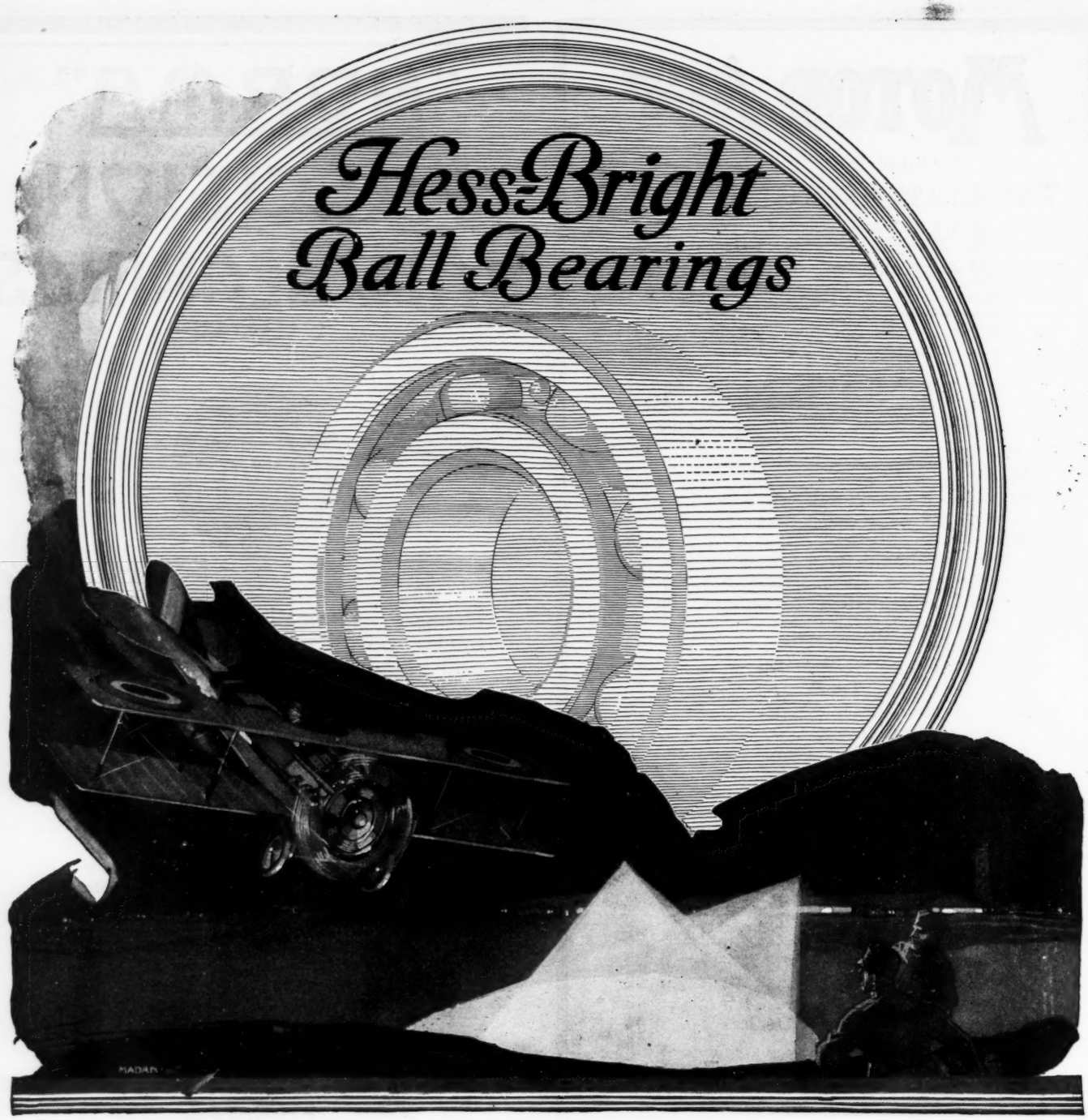
"NORMA"
PRECISION
BALL BEARINGS
(PATENTED)

Detailed examination of a car, truck, tractor, power boat or airplane, may reveal initial values. But only the test of service—the supreme test—can reveal the ultimate values which determine whether the investment was good or bad. An automotive unit, or any of the secondary units composing it, can be justly judged only on its record of performance.

In America and abroad, in civil and military service, the cars, trucks, tractors, power boats and airplanes with creditable records of duty well done, almost without exception carry ignition apparatus and lighting generators in which "NORMA" Ball Bearings are used.

Be SURE. See that your Electrical Apparatus is "NORMA" Equipped.

THE NORMA COMPANY OF AMERICA
1790 BROADWAY NEW YORK
Ball, Roller, Thrust and Combination Bearings



He must know his bearings—

else the hazard of his landing may ruin a successful flight. As he knows such bearings, so too, must he know those in his mount—as to strength and certainty of performance.

For where excess strain or exceptional loads must be handled without warning—nothing but a product proven in service equally as gruelling will do.

Hess-Bright Ball Bearings have a reputation to sustain. And it is built on the same performance that upholds it. Hess-Brights will do their work well—in your service on car or truck—where the strain and stress is petty compared to the limit they are able to stand. By the manner of their making they cannot fail.

THE HESS-BRIGHT MANUFACTURING COMPANY
Philadelphia, Pa.

Where Performance takes Preference over Price

Vol. XXXV, No. 2 Chicago, January 9, 1918 $3.00 Per Year

MOTOR AGE

A salvage park in France. The going is so bad a Nash and a Holt are hitched on the wrecked car

The M. T. C. in France

By W. F. Bradley

Motor Age Special European Correspondent

In Two Parts—Part I

THIS article by Mr. Bradley is one of the first comprehensive stories on the work of the Motor Transport Corps in France to be released. In it are given statistics on the number of motor vehicles, their makes, etc., in the hands of the A. E. F., with details of the way in which motors served our own army—Editor.

HAD America been a professional fighting nation, with every detail of its army organization perfected in theory and in practice, the task of providing motor transportation for an expeditionary force of more than 2,000,000 men would have been a full man-sized job.

But when Uncle Sam rolled up his sleeves, his entire knowledge of motor car transportation under war conditions had been gained on the Mexican border and from very meager official reports from Europe. The very little motor transportation he possessed was in the hands of the Quartermaster Corps and was altogether inadequate for a great European war. When that steady stream of traffic began to flow across the Atlantic every individual organization fought for shipping space, and the most powerful got it. The motor service, being technically non-combatant and influentially weak, got squeezed out until the more powerful army organizations in France began to realize that by leaving the motor service in the rear they had been abandoning their most valuable ally.

Thus, while automotive men in America were laying wonderful plans for standardized trucks, the automotive men in France were scouring the country for anything which had wheels and burned gasoline. They found these cars and trucks in France, in Italy, in England, in Spain and even got some "orphans" born in Germany and Holland.

TO give an idea of the size and importance of the Motor Transport Corps, it is only necessary to state that it has under its control about 81,000 vehicles, composed of 7575 passenger cars, 32,500 trucks, 18,000 motorcycles, about 4300 trailers and 19,000 bicycles. These, together with the stock of spare parts, tools and machinery on hand at the date of the armistice, represent a value of not less than $175,000,000.

Thus, while it can be considered a full-size man's job to run a motor service for a 2,500,000 army, when the organization is perfect and the supplies are regular, it has to be admitted that it adds considerably to the complexity of the task when it is necessary to organize a service and run it at the same time, when the main source of supply is 4000 miles away and unprepared, when the lines of communication are open to attack and when the unsatisfactory expedient of begging vehicles from whatever European factory can furnish them has to be indulged in.

It was about a year ago that the army motor service was taken out of the hands

of the quartermaster and vested in the Motor Transport Service later, which is now known as the Motor Transport Corps. Boiled down and stripped of its legal and military phraseology, the general order which brought this change into-effect gave the M. T. C. complete control over all motor vehicles in the service of supply of the American Expeditionary Forces and entrusted it with technical supervision over motor transportati n in the zone of advance.

The organization is distinctive, differing entirely from that of the French army and only corresponding in a general sort of way with that of England. The overseas division of the Motor Transport Corps, has at its head, Brig-Gen. M. L. Walker, with headquarters of the corps in Tours, less than half way up the main line of communication.

To give an idea of the size and importance of the Motor Transport Corps, it is only necessary to state that it has under its control about 81,000 vehicles composed of 7575 passenger cars, 32,500 trucks, 18,000 motorcycles, about 4300 trailers and 19,000 bicycles. These, together with the stock of spare parts, tools and machinery on hand at the date of the armistice, represent a value of not less than $175,000,000. At the same date the number of enlisted men in the Motor Transport Corps of the entire A. E. F. was 20,392 and the number of officers, 1032.

Directs All Motor Transportation

The Motor Transport Corps has charge of all the motor transportation of the American Expeditionary Forces. In the early days some of the corps had their own transportation. The most conspicuous example was the Aviation Section of the Signal Corps, which got together quite an important fleet of motor vehicles before the present M. T. C. came into existence. It was felt that there should be a motor service for the entire army and not a separate service for each corps.

The pooling of the motor vehicles met with a considerable amount of criticism, particularly from those services which had got motor transportation together before the M. T. C. was formed. This system of pooling is undoubtedly the most economical in the long run, for it simplifies supply and

THE work of the Motor Transport Corps was rendered difficult by reason of conditions for which the nature of the war alone was responsible. Troops and primary necessities were brought over faster than motor vehicles and their supplies, with the result that the first American forces to land in France went out and bought whatever happened to be available. . . . Thus, the army which has made the greatest efforts toward standardization has at the present time fifty-one makes of foreign passenger cars, five makes of American passenger cars, twenty-three makes of 1½-ton trucks, twenty-one makes of 3-ton trucks, six makes of 5-ton trucks, thirty-four makes of American trailers and at least twenty European makes.

maintenance and puts vehicles in service just where they are wanted. With divided control one set of vehicles may be idle or only partially employed, while a neighboring set is overworked or so inadequate in numbers that the efficiency of the whole army is impaired. This system of pooling has been developed to an even greater degree in the French army than in the American forces, notwithstanding the fact that the French run a practically independent motor transport corps for the aviation and artillery.

The work of the Motor Transport Corps was rendered difficult by reason of conditions for which the nature of the war alone was responsible. Troops and primary necessities were brought over faster than motor vehicles and their supplies, with the result that the first American forces to land in France went out and bought whatever happened to be available. For any organization whose work was held up for lack of trucks and cars it was the most natural thing in the world to buy an urgently needed car without inquiring too closely how supplies were going to be obtained later to keep it in condition. Thus, the army which has made the greatest efforts toward standardization has at the present time fifty-one makes of foreign passenger cars, five makes of American motorcycles and nine foreign makes. There are twenty-six different makes of American passenger cars, twenty-three makes of 1½-ton trucks, twenty-one makes of 3-ton trucks, six makes of 5-ton trucks, thirty-four makes of American trailers and at least twenty European makes. Before some of the "orphans" were salvaged, there were 169 different makes of passenger cars—American and foreign—to be cared for.

Outside organizations, such as the Y. M. C. A., the Salvation Army, K. of C., etc., own sixty-six foreign makes of cars or trucks and twenty-nine different American makes, all of which the Motor Transport Corps has to father. Many of these trucks and cars are altogether unknown to Americans at home and only slightly known to Europeans. Their purchase was made under absolute necessity, but their maintenance always will be a very serious problem for the M. T. C.

A variety of types of motor vehicles is inevitable, no matter how thoroughly the standardization idea is followed. The M. T. C. is responsible for the motor transportation of the army with the exception of kitchen trailers, which belong to the Quartermaster; tanks, which are under the control of the Ordnance Corps; and a very few of special vehicles for the Air Service. Originally some of the branches of the service had their own transportation, the most important of these branch transportation services being that of the Air Service. When they were all grouped under the M. T. C. a list very carefully was prepared of necessary types to cover the needs of the entire army, and although this list assumed that there would be but three makes of passenger cars, it totaled 112 different types of cars, trucks and trailers.

Later, by close team work, it was possible to reduce this number to rather less than 100 types which were essential to the needs of the army.

Parts for Forty-one Makes

It is absolutely impossible to keep stocks of parts of every "orphan" car which gets into the service under dire necessity. But complete stocks are kept for forty-one makes of cars and trucks. This means that there are forty-one different makes of passenger cars for which the M. T. C. is prepared to supply at a moment's notice any part likely to need replacement. This supply organization is immense, for the number of parts listed and always on hand to meet requisitions total 90,000. No other branch of the service has anything like such a huge stock. It is believed that the engineers come second, but their stock of listed live articles is not half that of the M. T. C. Further, the M. T. C. list cannot be reduced nor can substitutes be offered.

If the quartermaster is out of beans, he can recommend rice as being just as good. But the M. T. C. supply officer who receives an urgent requisition for a French Renault crankshaft is unable to put forward half a dozen Ford shafts in its stead. The great cry in the M. T. C. is for standardization, and it is toward this end that they are working. With every new make of car which goes into service the possibility has to be faced of providing 3000 individual parts as replacements. So serious is this problem that M. T. C. supply officers would prefer to have in use one indifferent make of truck rather than an equal number of good trucks produced from six factories. (*Concluded next week*)

These German prisoners are used by the Motor Transport Corps as laborers. This is a scene in a large salvage park, which covers 400 acres and is well covered with buildings and material

Big Time for Dealers in Chicago and at Shows

Tentative Program Is Outlined for the Annual Meet

ST. LOUIS, Mo., Jan. 4—A tentative program for the annual meeting of the National Automobile Dealers' Association in Chicago Jan. 28-29 has been outlined. All the meetings are to be held at the LaSalle hotel, with the general meetings in the Red room and the office on the eighteenth floor. The big event, aside from the work of getting the association in shape for next year, will be the frolic, at which all hands will be guests of the Chicago Automobile Trade Association, and anyone who talks business will be fined.

George M. Graham, chairman of the motor truck committee of the National Automobile Chamber of Commerce, and John N. Willys, president of Willys-Overland, are on the program for the first afternoon, though Mr. Willys has not definitely decided whether he can be present. Short talks on good roads, salesmanship, cost keeping, business efficiency and advertising will follow.

Wednesday the accomplishments of the association will be reviewed in short talks by officers with 4-min. talks by various members. Officers will be elected that afternoon, and in the evening the banquet and trade frolic will be given by the Chicago Automobile Trade Association.

ACCESSORY MAKERS DRAW SPACE

Chicago, Jan. 6—Space for the nineteenth annual motor show in Chicago has been alloted to its members by the Motor and Accessory Manufacturers' Association, both for the passenger car exhibition, Jan. 25-Feb. 1, and the truck, Feb. 3-6. Eighty-one spaces were assigned for the former dates and thirty-four for the latter. Sam Miles, manager of the show, also has on file applications for space from thirty manufacturers of accessories who are not members of the M. & A. M. A.

In addition to the exhibitors alloted space in the car and truck sections last week are the following:

Passenger cars—Biddle, Allen, Dorris, Ford, Saxon, Auburn and Apperson.

Trucks—Fowler, Winslow, Dorris, Sanford and Ford.

ALL SET FOR SIOUX FALLS

Sioux Falls, S. D., Jan. 4—Talks on tractors and exhibitions of tractors will occupy a large part of the interest at the twentieth annual convention of the South Dakota Implement Dealers' Association here Jan. 14-17. In addition to addresses on subjects of moment to the automotive dealer, as well as the purely implement dealer, a four-day show will be held in the city coliseum with tractors, trucks, implements and other vehicles on display.

Among the addresses are: "Helping the Implement Dealer Collect His Accounts," by Frank G. Odell, Omaha, Neb.; "Tractors," H. L. Thomson, Moline, Ill.; "The Dealer's Side of the Question," F. R. Sebenthall, Eau Claire, Wis.; "The Farmer's Side of the Implement Question," Frank B. White, Chicago; "Why Prices Will Not Decline," Floyd R. Todd, Moline, Ill.

The outlook for 1919 is an encouraging one, and the dealers look for great prosperity; hence, the interest in the meeting. The convention was to have been held in December but was postponed on account of the influenza epidemic.

HIGHWAYS TO MEET

Kansas City, Mo., Jan. 4—Kansas City is planning a welcome for the convention of highway associations which will be held here Jan. 21. Thirteen transcontinental and inter-state highway associations will be represented at the meeting, which is to perfect a league of the active, specific highways associations of the United States. Any association organized and active in the promotion of the construction of a definite, specific and uniformly marked highway not less than 500 miles long, passing through not less than three states, is eligible to attend, and each will be allowed one vote for each state through which it passes.

TRACTOR BUILDING GOING UP

Kansas City, Mo., Jan. 3—A temporary building is being erected on the Union Station Plaza for the fourth national tractor show, which is to be held here Feb. 24-March 1. Steam pipes are being laid from the heating plant in Union Station. Suites of rooms for the use of exhibitors who plan meetings of salesmen, distributers and prospective dealers will be a feature this year. Rest rooms, nursery and play rooms will be provided for children who come with their parents.

Many foreign representatives are expected. Among the visitors already announced are the Russian mission, the Italian delegation of agricultural engineers, a technical expert from the British minister of agriculture, a commissioner of the French government, commissioners from South America and representatives of foreign distributers of American products.

Truck Makers Draw Space for New York Dates

NEW YORK, Jan. 6—Practically every inch of available truck space in both Madison Square Garden and the armory has been allotted for truck exhibits for the nineteenth annual New York show. Four spaces remain unallotted, but there are thirty applicants for them. This section of the show will be held Feb. 10-15, immediately after the passenger car exhibit, Feb. 1-8. The following trucks will be represented:

In Madison Square Garden—United States, Columbia, Locomobile, Autocar, Master, Oldsmobile, Dodge Brothers, Day-Elder, Packard, Velie, Atlas, Maxwell, Le-Peer, Chevrolet, Reo, Overland, Giant, Oneida, Western Electric, Federal, Denby, Fulton, Hall, Hay-Dee extended Fords and Babcock bodies.

In the armory—Republic, Diamond T, Wilcox, Stewart, Paige, C. W. Moody, Mack, Signal, Sullivan, Hurlburt, Nash, Titan, Warner trailer, Garford, Selden, Menominee, Sterling, Rainier, Kelly-Springfield, Schacht.

A feature of both sections of the show will be the body displays. A section of the armory has been set aside exclusively for body makers in the passenger car section, and as there will be no salon in New York this year some of the exclusive body makers will be found here this season. During the second week new types of commercial bodies will be displayed in the armory.

HAVE A HEART, AUGUST!

Chicago, Jan. 6—Newspaper dispatches are to the effect that the fourth son of Mr. William Hohenzollern, ex-Prince August William, has taken a situation with a widely known German motor car firm. The ex-prince probably knows a good business when he sees it, but is that any reason why he should make it harder for his fellow-countrymen to make a living? Well—ho, hum—add another reason why the world should boycott German-made goods in post-war trade.

New Year's Dealer Resolutions

Memphis, Tenn., Jan. 4—The Memphis Automobile Dealers' Association has laid out rules of conduct for the coming year and advertises in the local papers thus:

"We resolve to conduct our business along the lines which shall assure our patrons of honest values and equitable service.

"We resolve to carry only dependable merchandise—automobiles and supplies in which we have absolute confidence, that we can recommend to our customers.

"We resolve to extend the same spirit of fairness to those with whom we deal as we look for in those who deal with us.

"We resolve to lend our every effort to the welfare of the city and territory in which we have our homes.

"We resolve to ask the co-operation of the public in keeping these resolutions."

Pennsylvania May Limit Truck Sizes

Will Consider Legislation for Regulation of Weight Borne by Roads

PHILADELPHIA, Pa., Jan. 3—The motor truck trade is deeply interested in the coming attempt in the legislature to limit the size of trucks which may be used on the highways of Pennsylvania. The subject will be a storm-center from the time of its introduction until final action, as some of the highway authorities are committed to obtaining such limitations.

Engineers declare that although the foundations to the roads have been made increasingly heavy each time they have been mended or constructed anew, the highways cannot stand up under 30-ton loads. Although haulage of trucks with 36-ton loads is against the law, in the eastern part of the state 35-ton loads constantly are passing over some of the highways. The gross weight of vehicles which may use the highways, under the present law, is limited to 24,000 lb. That means that truck and load must not weigh over 12 tons.

The proposed limitation would insure trucks of a width which would not inconvenience other road users. The proposition also is to have a provision making it necessary to carry lights on all vehicles at night, no matter how propelled. Such a provision was carried in the bill in the 1917 session but was defeated through opposition from the country districts.

The law approved July 7, 1913, provides that no vehicle shall be registerable in Pennsylvania which has an outside width of more than 90 in., unless it is a bus for carrying passengers within the city limits only. Such passenger vehicles are allowed a width of 100 in. outside. A width of 90 in. is only 7½ ft., and it is asserted that there are in the state hundreds of trucks of considerably greater width than that. It would work considerable hardship were these to be legislated off the highways, it is said. The state highway department at Harrisburg each week receives numerous complaints directed against cars and motor trucks which have violated the rules of the road.

Some motor car men take the stand that were highways to be properly constructed, they would stand up under the heavier trucks and that the law really should be directed toward this end.

WILMINGTON PLANS SHOW

Wilmington, Del., Jan. 3—Arrangements for a show in this city were made recently at a meeting of the Automobile Dealers' Association of Wilmington. The date of the show will be fixed when the dealers meet again Jan. 10.

DEALERS DRAFT NEW LAWS

Little Rock, Ark., Jan. 3—A law making it a felony to borrow, move or use for any purpose whatever car or truck without the consent of the owner and providing a penalty of from one to five years imprisonment in the state penitentiary, is being framed by the legislative committee of the Little Rock Automobile Dealers' Association, to be presented to the next session of the Arkansas legislature, which convenes Jan. 14. Provisions also will be included for the punishment of men covering up the theft of accessories.

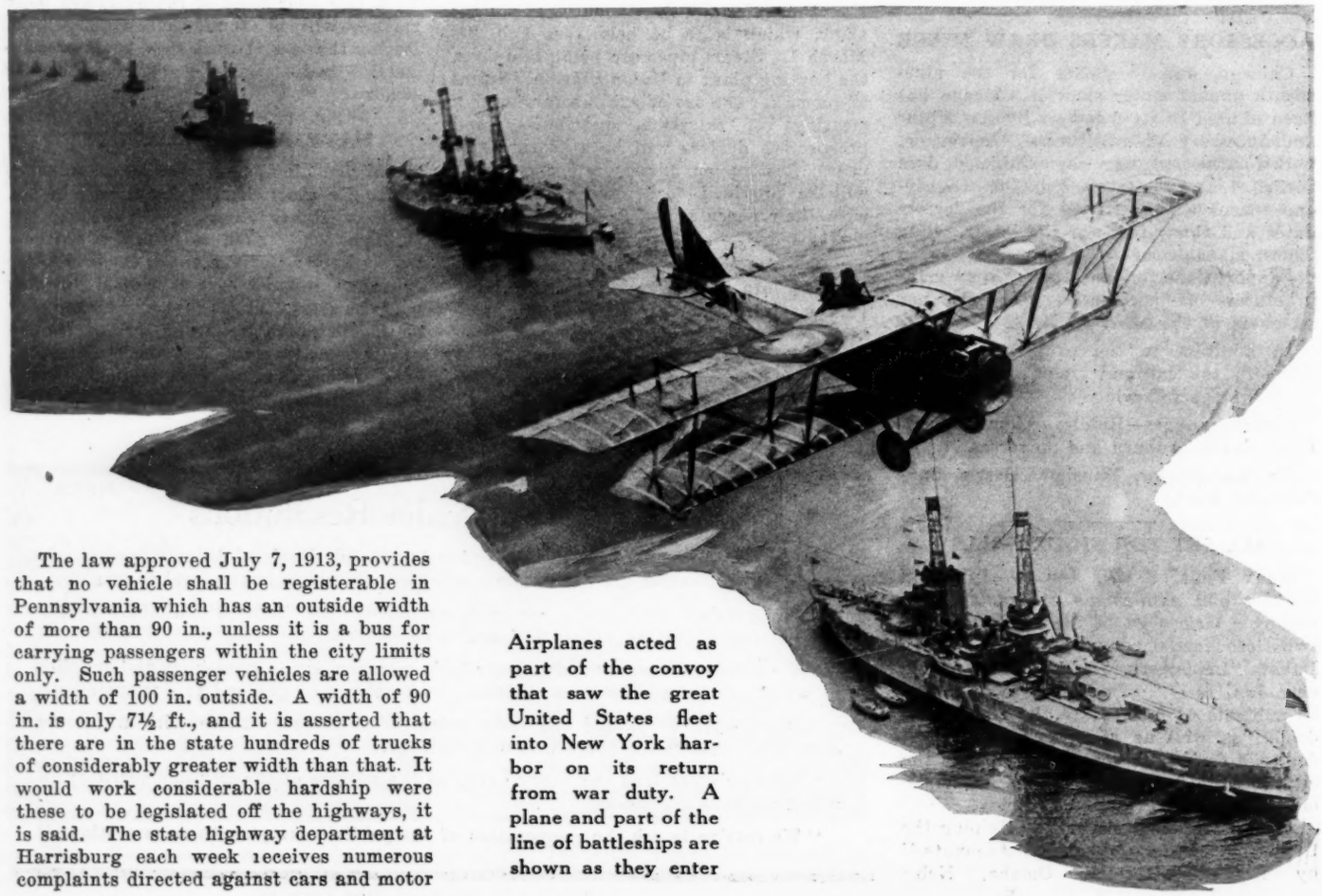
The dealers' association will ask for relief from the provisions of the bone dry law which provides that the state shall confiscate any car caught importing liquor into the state. Dealers claim that in many cases cars have been seized upon which the dealer held a lien for a part payment on the car. It is the contention of the dealers that they should not be made responsible for the morals of the purchaser of a car.

BOSTON DEALERS ACTIVE

Boston, Mass., Jan. 6—The motor situation in Boston begins to loom up better every day. George Leghorn, who took on the Liberty a few weeks ago, has leased the large salesroom formerly occupied by the Jackson Motor Car Co.

Sherwood Hall, who took the Hupmobile when Mr. Leghorn dropped it, has made several changes in the building where he has it, turning the first part of the floor into a showroom with effective decorations. F. J. Caldwell, who took the Mercer, has just opened new salesrooms. The Hood Tire Sales Co. has leased the other half of this new building. The Hall Motor Truck Co. is housed in the G. M. C. building, and the Boston Oldsmobile Co., a new corporation, has thrown open the doors of its new home, the former Kissel building.

W. G. McGrath, who has taken on the Little Giant agency for Boston and vicinity, has leased salesrooms, and the former home of Frank E. Wing, who has the Marmon and Hurlburt, has been taken over by the Boyce Motor Equipment Co. Mr. Wing now occupies a new building. The



Airplanes acted as part of the convoy that saw the great United States fleet into New York harbor on its return from war duty. A plane and part of the line of battleships are shown as they enter

Henley-Kim Co., Hudson dealer, has spent several thousand dollars redecorating its place.

Judging by the way inquiries are being made it will not be difficult to place agencies for good cars and trucks in Boston. One man prominent in real estate circles has been making inquiries about the probable cost of assembling a car in Boston for sale in New England.

SILVER TO WHOLESALE ONLY

New York, Jan. 3—C. T. Silver has opened executive offices in his new building and will give up entirely for the time being the retail end of the motor car business. The nine-story building occupied for years by him has passed into the hands of General Motors, which already owned the adjoining building to the north. General Motors has taken possession, and it is understood the two structures will be thrown together to house all the executive offices of its multifarious activities.

Retailing of Giant trucks in New York and Kissel cars in New York and Brooklyn has been placed in the hands of L. W. Mulford, who also takes over the Silver service station and will keep parts and furnish service for the Apperson, Kissel and Giant lines. Aside from acting as distributer, Mr. Silver plans to enter into the exporting of cars and trucks.

FIRESTONE PROFITS $8,320,442

Akron, Ohio, Jan. 3—Sales of the Firestone Tire & Rubber Co. increased 23.7 per cent during the year ending Oct. 31 as compared with the previous year. In 1917 sales totaled $61,587,506 as against $75,801,219 for 1918. These figures, made public at the annual meeting of the company, also make plain that profits for the year, after a liberal reserve for depreciation and taxes, etc., amounted to $8,320,442.

LONG-DISTANCE SEAPLANE

New York, Jan. 4—Two long flights in navy seaplanes have recently been completed, one from the Naval air station at Pensacola and the other from Norfolk, Va. Lieut. T. C. Rodman, U. S. Marine Corps, Dec. 30 flew 900 miles from the Pensacola station, carrying eleven passengers. The same day Lieut. Commander Bellinger, U. S. N., covered a distance of 651 miles from the Norfolk station without stop, carrying five passengers.

TIRE MAKERS TO MEET

New York, Jan. 4—All pneumatic tire and tube makers and all solid tire makers have been invited to meet here Jan. 15-16 to form new divisions of the Rubber Association of America, which will carry on the work of standardization of tire sizes. The solid tire makers are to meet at the Yale Club Jan. 15 and the others at the Hotel McAlpin Jan. 16.

REO GUARANTEES PRICES

Lansing, Mich., Jan. 4—The Reo Motor Car Co. has guaranteed present prices on its various models until July. They are as follows: Five-passenger, $1,395; three-passenger, $1,395; four-passenger coupe, $2,175; five-passenger sedan, $2,175; speed wagon chassis, $1,250.

State Considers Drastic License Fees

Massachusetts May Charge $200 a Ton for Trucks Over 10,000 Pounds

BOSTON, Mass., Jan. 4—Motor truck owners and dealers in trucks and cars throughout Massachusetts will find that they will have to pay a very much larger sum to the state if the report submitted by the joint committee to investigate motor matters is accepted by the legislature.

This committee, comprising the highway commission members, Col. W. D. Sohier, Frank D. Kemp and James W. Synan, together with Secretary of State A. P. Langtry and Thomas W. White, state supervisor of administration, held a public meeting Nov. 8 which was attended by motor representatives.

The most important and drastic section provides for the fees for motor trucks. At present the truck owners pay $5 for 1 ton and $3 for each additional ton. It took years of fighting by the highway commission to get the additional $3 per ton. An attempt last year to increase the fees so that they would be a flat $10 a ton was defeated. That was one reason why the present committee was selected to look into motor affairs. The new fees provide:

1	ton	$ 15
1½	tons	30
2	tons	40
2½	tons	50
3	tons	75
4	tons	100
4½	tons	150
5	tons	200

For every additional ton there would be a charge of $200.

These fees would be paid by the owners of the motor vehicles.

The dealers at present are allowed several license plates for their cars, which are registered at a lower price than those in use all the time by owners. The report suggests that cars of dealers pay the same fees as that of the owners, and where a large dealer has several machines it will jump up his expenses considerably.

Three Dealer Classes

On top of that comes the division of motor dealers into three classes: those who sell machines, new and used; those who deal in used cars solely, and those who buy cars for junk. They must all take out licenses in the city or town where they do business. A fee for this may be as high as $100. Moreover, they must report every day to the highway commission every car or parts of machines taken in trade or bought.

Those licensed under classes 11 and 111 must hold their cars at least four days before reselling unless given special permission. This is the outcome of the hearings held for the last two years on the question of stopping the thefts of motor cars.

The weight load of tons is restricted to 6 tons and the length overall of trucks and trailers 26½ ft.; height, 11 ft.; width, 92 in. Jitneys are to be limited to their carrying capacity for seats, with the exception that children under seven may be carried in adults' laps.

Mr. White filed a separate report recommending that the renewal fees be jumped from $1 to $2, also that the registration of vehicles be placed under the secretary of state's office.

When the report was made public steps were taken immediately by some of the motor bodies to get busy to make a fight against some of the provisions.

The Bay State A. A. board of directors will be called together Monday noon to plan action, and the Boston Automobile Dealers' Association will be asked at that time to join in a concerted movement to form a committee of owners and dealers such as was brought into being a few years ago when increased taxes were proposed for motorists.

CHANDLER TAKES OFF $300

Cleveland, Ohio, Jan. 6—Chandler has found it possible to return to the price of $1,795 on its four-passenger and seven-passenger roadster. Just seven days before the signing of the armistice an increase of $300 was announced. While this is removed now, it does not mean that the entire increase during the war period is off. New prices are:

	New Price	Old Price
4-pass. roadster	$1,795	$2,095
7-pass. touring	1,795	2,095
4-pass. dispatch	1,875	2,175
Convertible sedan	2,495	2,795
Convertible coupe	2,395	2,695
Limousine	3,095	3,395

BUICK PRICES STILL HIGHER

Flint, Mich., Jan. 4—Although Buick announced decreases in prices last week of $100, this does not mean that all the increase made during the war has been removed. Nov. 18 prices were increased $330, which alone leaves a raise of $230 in effect now, Buick having seen fit to take off about a third of the increase. The four-passenger coupe which is priced at $1,985 now was raised to $2,085 and not $2,850 on Nov. 18, as indicated in last week's issue.

RICK MAY FLY OVER HERE

Washington, Jan. 3—Eddie Rickenbacher, American ace in the flying service in Europe, may make a series of flights through the United States this spring at the time of the next Liberty Loan under the auspices of the Treasury Department. The Treasury Department is now negotiating with the War Department on this matter.

RICK GETS NEW HONORS

Paris, France, Jan. 4—Special cable—Capt. Edward Rickenbacher, foremost among American aces, has won further distinction. He has been awarded the French Legion of Honor in recognition of his military services.

EDITORIAL

Makers Should Back Shows

MOTOR shows this year, despite the fact that they are not under the auspices of a national organization of manufacturers, should have the fullest backing of the manufacturers, both by organizations and by individual manufacturers. The shows are needed this year as never before. Conditions made it impossible for the industry to start commercial production and distribution immediately upon the signing of the armistice, and a period of uncertainty on the part of manufacturers, dealers and the buying public ensued, and still exists, to an extent. It requires some concerted action on the part of manufacturers and dealers to restore the temporarily lowered buying morale of the public and of the dealers.

MANUFACTURERS who fail to take advantage of the dealers' shows are missing the best opportunity to overcome the deadening effect on the buying urge caused by war's restrictions in the public mind and to increase their distribution through personal contact with dealers.

SOME of the accessory manufacturers have felt that their men should be out on the road, placing the line, instead of spending their time at accessory exhibits. This is a false economy. One large manufacturer of a motor car part had definitely decided not to exhibit this year, although in previous years he has been an ardent supporter of the shows. His reasons were that the outlay required for the exhibit and the time of his men might better be spent in road work. When the true facts were presented in the light of the value he would obtain and his duty to the industry as a whole, he reconsidered and now plans to support by his exhibit space all of the more important local exhibitions. The welfare of the industry for the next year demands the whole-souled support of shows by the manufacturers.

Road-Building as Reconstruction

OUR neighbor over the northern border well might make us pause these days and think! Road-building is to be an important factor in the reconstruction of Canada. A program of public road-building of national scope has been outlined and is approved by the minister of public works and minister of immigration. Most of a transcontinental highway from Moncton on the Atlantic to Vancouver on the Pacific has been built, but this is to be linked together now by stretches across the Rockies and in parts of the highlands of Ontario. A new tourist highway from Edmonton westward into the Rockies to Jaspar park and eventually clear through the Prince Rupert is announced. Manitoba alone will spend $5,000,000 on roads. One reason advanced for extensive road work is that immigration will follow the course of the highways.

MEANWHILE our own country is not totally inactive along these lines, with $60,000,000 road bonds in Illinois, $50,000,000 in Pennsylvania, others proposed and still others partly converted into highways. But the work should go on, and it cannot go on too rapidly for the country's own good. It is to be hoped indeed that the meeting of highways at Kansas City this month for the purpose of forming a league for the bringing about of more extensive road-building will accomplish its aim. Meanwhile, every little helps. This means that every dealer, every motor club member, as well as every highway association member, can do his part to improve the roads in his community and, as soon as is possible, bring about the construction of permanent roads so built that they will stand up under the traffic of motor trucks, which in themselves are most necessary.

Demand on American Makers

REPORTS from those who have had the opportunity to see the extent of the destruction war has wrought in Belgium and northern France assert that the work of agricultural rehabilitation in those districts will result in demands for power and equipment upon the United States which will seriously affect domestic trade conditions.

IT is said that northern France alone, along the line where the battles of the war have been raging for the last four years, will require a minimum supply of 88,000 horses, 25,000 tractors and large quantities of wagons and tillage implements. The providing of this is characterized as not only a sentimental duty but also as an economic necessity. Furthermore, America is being looked to assume the duty of supplying these deficiencies.

IN the past much of the equipment for this section came from Germany and England. Owing to the war and the mental condition following, the former at the present time is disqualified, both by reason of the aversion in which she is held by French buyers, and by reason of deficient manufacturing facilities, from resuming former business relations. England, also, it is said, can do very little or nothing, owing to the difficulty which will be experienced in reconverting her factories to peaceful pursuits.

IN addition, as a war emergency, many American-made tractors have been introduced into France during the last two years and these have made a hit. Likewise the operative equipment which goes with them. France in consequence demands immense additional supplies of American made farm equipment, both for power and for tillage. These demands must be met.

IF this duty is met, as it will be met in part at any rate, it will bring as a consequence a shortage in the supply of farm equipment for domestic uses. It is well to consider now what

this will mean. It will mean that dealers must make early and definite arrangements for tractors and equipment to meet their local needs. Delay in doing so will carry the danger of trade loss. It is certain the demand for American-made tractors and tools will be heavy and insistent. Therefore, it behooves the tractor dealers to file specifications for their probable requirements for the coming year as soon as possible and then to insist upon early shipment.

U. S. A. Motors Overseas

IN this issue appears one of the first stories of its kind to be released for publication. There will be others with perhaps more extensive information, but this is extensive indeed in view of the fact that this information has been withheld, of necessity, during hostilities and only released with the signing of the armistice. MOTOR AGE is particularly fortunate in having on the spot in Europe such a man as the writer, who is fitted by education, knowledge of the country and first-hand observations to report for its readers the part U. S. A. motors have been playing on the other side of the seas.

IT is interesting to learn the total number of motors with the A. E. F. The Motor Transport Corps has charge of all the motor transportation of the A. E. F.. It has under its control about 81,000 vehicles, as follows: 7575 passenger cars, 32,500 trucks, 18,000 motorcycles, about 4300 trailers and 19,000 bicycles. These, together with the stock of spare parts, tools and machinery on hand at the signing of the armistice, represent a value of not less than $17,500,000. At the same time the Motor Transport Corps had 20,392 men and 1032 officers. Its work is immense, a colossal task.

ALL France is divided into three main portions, each of which serves its particular section. One main receiving station is provided, and this stores 4000 vehicles. But details are contained elsewhere in this issue. Let it suffice to say that the signing of the armistice has brought little change in the work of the Motor Transport Corps. Food has to be transported as usual, and lines of communication have been lengthened. As long as an army of occupation is in Europe, the Motor Transport Corps will keep busy, and reconstruction will throw even more work on it.

BY AIR TO INDIA

Paris, Dec. 18—By mail—For the first time the journey from England to India has been completed by airplane. The trip which ended at Karachi, India, on Dec. 17, was made in a Handley-Page bombing plane equipped with four Rolls-Royce Eagle engines and was piloted by Maj. A. S. MacLaren and Captain Halley. The total mileage was close to 6000 and was made in stages varying in length from 652 to 1170 miles.

POSTOFFICE RETURNS AIRPLANES

Washington, Jan. 3—The Postoffice Department has turned back to the War Department 100 De Haviland 4 airplanes which, it is said, have proven utterly unfit for cross-country mail flying. This action followed extensive flight and service tests between New York and Chicago and Washington and New York, which, it is said, showed the planes to be unadaptable for the heavy postal work. Postal officials stated here that several of the planes crumpled in making landings and taking off for flights and several accidents, including one fatality, resulted.

The War Department also has furnished the Postoffice twelve two-engine Handley-Page planes which shortly will be assembled and put on the New York-Chicago mail route.

GRAHAM IS PROMOTED

Buffalo, N. Y., Jan. 3—George M. Graham has been promoted from assistant commercial manager of the Pierce-Arrow Automobile Co. to sales manager, effective Jan. 1. He succeeds W. J. Foss, who becomes second vice-president.

ORDER AGAINST VACUUM OIL

Washington, Jan. 3—The Vacuum Oil Co., New York, has been ordered by the Federal Trade Commission to discontinue shipping its products without having previously sold or received orders for them from customers, prospective customers, or customers or prospective customers of its competitors. The order further prohibits the company from "inducing or attempting to induce in any manner whatsoever" consignees to accept such unbought or unordered shipments.

The company has admitted, states the Federal Trade Commission, to have made shipments at market prices of "large quantities of its products without having heretofore sold or received orders from the same," and attempted to induce the consignee to accept by the extension of long-time credits and guaranteeing resale of such consignments and the assistance of the firm's salesmen in disposing of the shipments. The order was issued on agreement with the concern, which waived right to introduce testimony in support of the practice.

FINDS AGAINST SILVEX

Washington, Jan. 3—The Federal Trade Commission has ordered the Silvex Co., Hellertown, Pa., maker of spark plugs, to discontinue representation that its "Bethlehem aviation" spark plug has been "certified by the United States Bureau of Standards." The commission found "that while large numbers of Silvex plugs had been furnished the Government and subjected to the usual Bureau of Standards tests, the Bethlehem aviation plug had not been 'certified' by the bureau as represented in a circular letter sent out by the company." The commission's order was issued by agreement with the company, which waived the right to introduce testimony in support of the act.

E-B PROMOTES JACKSON

Rockford, Ill., Jan. 3—Albert T. Jackson has been elected vice-president of the Emerson-Brantingham Implement Co. to succeed Fred Glover, who resigned to enter Government service. Mr. Jackson formerly was at the head of the carriage and wagon interests as assistant trade manager and general sales manager, becoming chairman of the board of directors when Ralph Emerson died.

PORTLAND SHOW IS SET

Portland, Ore., Jan. 3—The Dealers' Motor Car Association of Oregon will stage its annual show in the Auditorium here Feb. 24-March 1. It is expected that 100 passenger cars, thirty-five trucks and twenty tractors will be shown, using 40,000 sq. ft. The show will be under the management of M. O. Wilkins.

PLANES STILL MAPPING COUNTRY

Washington, Jan. 3—The four Army training planes which flew across the continent from San Diego, Cal., to Jacksonville, Fla., and which later flew the length of Florida and back, have started north to Washington. They left Dorr field, Arcadia, Fla., at 3:30 p. m., Dec. 27 and arrived at Daytona, Fla., at 6:00 p. m. the same day, flying the last hour of this leg in the rain. The flyers spent the night at Daytona and left this morning for the north. They will continue to collect data and statistics for the Army air map and locate sites for landing fields.

TAX ON EXPORTED CARS

New York, Jan. 6—Passenger cars and trucks sold by the manufacturer on a bona fide export order are not taxable under the provisions of the present war revenue bill, according to a ruling which the National Automobile Chamber has just received from the treasury department. But where a car or truck is sold to a domestic concern and subsequently exported at the instance of the buyer, the tax is collectible.

The ruling makes plain that a sale to a concern doing business in the United States is a domestic sale unless the terms of the original order or contract of sale show that the seller is to export the vehicle, or that he is to make such a delivery of it as will result in its exportation; in the latter case the tax is not to be collected. Where a car or truck is sold by a manufacturer, and subsequently exported, the manufacturer must pay the tax. To claim exemption from payment of the tax, the person making claim must show he is the exporter.

U. S. Buys $1,000,000 Worth of Tires

Order Is Given at Same Time for 1000 Cargo Trailers

WASHINGTON, Jan. 3—Government purchases of tires for motor trucks in this country and abroad continue in large quantities. Orders were placed Dec. 17 for $1,000,000 worth of tires with Goodyear, Kelly-Springfield, Fisk, Firestone, United States and Pennsylvania. An order at the same time was given to the Trailmobile Co. for 1000 cargo trailers. Following is the list:

Trailmobile Co., Cincinnati, Ohio, 1000 cargo trailers, $569,000.

Goodyear Tire & Rubber Co., 5750 casings, 6000 tubes, $230,720.

Kelly-Springfield Tire Co., 2000 tires, $80,680.

Fisk Rubber Co., 3765 casings, $57,003.50.

Firestone Tire & Rubber Co., 1965 casings, 5875 tubings, $76,874.25.

United States Tire Co., casings and tubes, $388,112.50.

Pennsylvania Rubber Co., 3000 casings, $31,500.

LONDON AMENDS GAS PRICES

Washington, Jan. 3—The London board of trade has arranged new wholesale prices for petroleum products, effective Dec. 16 as follows:

Gas oil in bulk at wharf, 17 cents per imperial gallon.

Fuel oil in bulk at wharf, $48.67 per ton.

From January 1, 1919: Spirit in cans—aviation, 77 cents; special boiling points, 72 cents; No. 1, 70 cents; No. 2, 68 cents; No. 3, 66 cents; kerosene—long-time burning oil, in bulk, 30 cents; No. 1, 30 cents; No. 2, 28 cents; raw white spirit ungraded and unrefined, to manufacturers, 55 cents.

All except where otherwise specified are per imperial gallon, which is equal to 1.2 United States gallons.

MAKING GOOD IN TRACTORS

Prairie du Sac, Wis., Jan. 3—Prompt response to calls for service is the policy which has made Charles Ploetz a success in the tractor business. For several years Mr. Ploetz has been in the general farm implement business, and it was not until along in the last year that the possibilites of the tractor trade made an effective appeal to him. Once he realized what they were he immediately got busy with the result that he secured the agency for the Wisconsin tractor. Also he put his sales organization to work. The accompanying illustration shows the first shipment of six tractors received by him. Quick sales took five of them, but the sixth was retained as a demonstration machine—a sort of nest egg, as it were. This demonstration machine, properly employed, and the quality of the service Ploetz has given on the tractors he has sold have established him firmly in the tractor business.

BATENBURG LEAVES F-W-D

Clintonville, Wis., Jan. 6—P. J. F. Batenburg has resigned his position with the Four Wheel Drive Auto Co., with which he has been associated as chief engineer and designer for the last eight years, being largely responsible for the rapid growth of the company.

Mr. Batenburg is the designer of the F-W-D trucks and is well known in this country and Europe as one of the most successful truck and tractor engineers. He is America's first successful four-wheel-drive designer and has contributed to the Allied cause a greater service than probably is appreciated outside of the capitals of the Allied countries. Although there are rumors, Mr. Batenburg insists that he has not made any other connections so far.

VELIE COMPLETES WAR ORDERS

Moline, Ill., Jan. 4—The Velie Motor Vehicle Co. has completed all war contracts, after four years of activity, commencing in 1914 when representatives of the French government placed with it orders for 2000 motor trucks. In 1916 1000 more were sent to the Mexican border for the use of United States troops, while in 1917, when the United States entered the war, many thousand more were ordered.

The Velie company supplied 3000 Liberty trucks. Later, an order was received for 1000 ¾-ton trucks. Then trailers were also manufactured for the heavy trucks.

The Velie company also turned out 25,000 small carts for carrying machine guns to their emplacements and to handle ammunition and other supplies. The order for the carts alone aggregated $3,000,000. The total of contracts handled during the war by the Velie company aggregated $10,000,000. This does not include the contracts handled prior to the entrance of the United States into the world war. The plant is now operating upon the normal peace basis again and is preparing for a huge volume of business during the new year.

REDDEN IN TRACTOR PROJECT

Chicago, Jan. 4—C. R. Redden, who has been working on the tractor idea for several years now, is to be identified with a new concern known as the Kill Toil Farm Tractor Corp. Associated with him will be Byron L. Baker, at one time general sales manager of the Advance-Rumely Co. and with the J. I. Case Threshing Machine Co. before that. Mr. Redden formerly was general sales manager of Maxwell and became active in making truck attachments about two years ago.

HANCH WINDING UP BUSINESS

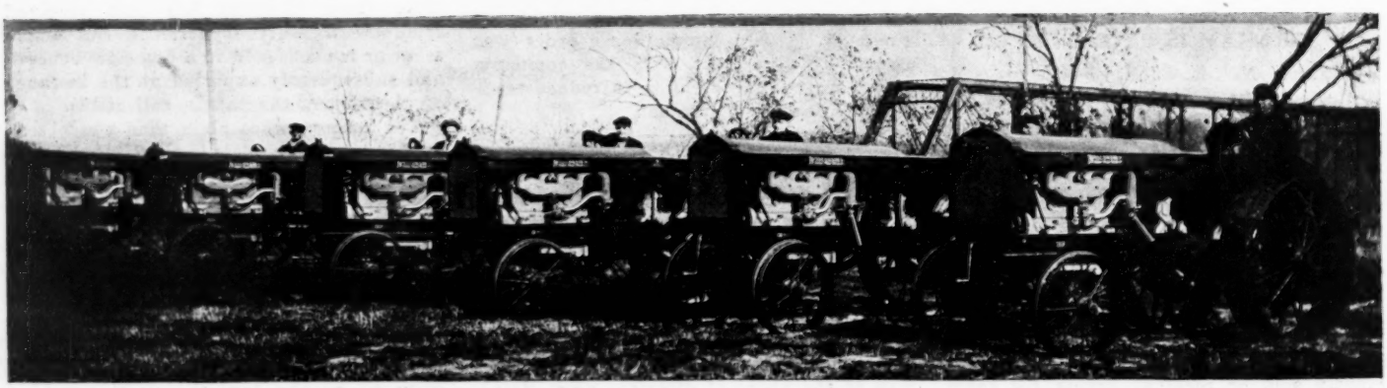
Washington, Jan. 3—C. C. Hanch, chief of the Automotive Section, War Industries Board, probably will complete his official duties in Washington by Jan. 15 and return to the Studebaker Corp., South Bend, Ind., of which he is treasurer. The Automotive Section is winding up its affairs as rapidly as possible, now completing a report in conjunction with the other sections of the board to be compiled into one complete statement of the board's activities by Bernard M. Baruch.

HINKLEY LINE OF ENGINES

Detroit, Jan. 4—The Hinkley Motors Corp., which has been engaged in the manufacture of the class B truck for the government for more than a year, will produce and market a full line of engines for the truck and tractor industries after Feb. 15. The corporation is returning to its original plans. Its product had been designed and its plant was being tooled for general production when the United States declared war. C. C. Hinkley, president of the corporation, was one of the engineers chosen by the S. A. E. to aid the Government in standardizing truck design.

MOON BACK ON CARS

St. Louis, Mo., Jan. 6—The Moon Motor Car Co. has again started production of the line of motor cars made before the war suspension with slight refinements worked



Six Wisconsin tractors lined up for delivery by Charles Ploetz of Prairie du Sac, Wis.

out during the period. It is announced that 50 per cent production will be reached by Feb. 15, and the percentage will be pushed rapidly to 100 per cent. Then the special buildings erected for the manufacture of 6-in. shells for the Navy will be brought into use for the motor car plant, much of the machinery provided for that work being available for use with some alterations.

STUDEBAKER BACK MARCH 1

South Bend, Ind., Jan. 6—The Studebaker Corp. gradually is converting its facilities back to peace-time work and will be able to make regular deliveries on its line March 1. This embraces the light four at $1,125; light six, $1,585; big six, $1,985; light four sedan, $1,685, and light six sedan, $2,185.

REEVES LEAVES WASHINGTON

Washington, Jan. 3—Alfred Reeves, general manager of the National Automobile Chamber of Commerce, who has been in Washington for some time conducting the office here, will return permanently to New York to-day. The Washington office will be continued indefinitely and will be conducted by Harry Perry.

TO MAKE NEW BEARINGS

Chicago, Jan. 4—The Perfection Roller Bearing Co. has been formed here and will place on the market several new types of roller bearings, including a non-lubricated bearing and one to install on the Ford rear axle. The organization is headed by C. M. Carr, and associated with him is William R. Bullion, as secretary. C. C. Bombaugh is vice-president and treasurer.

WALL TO RETURN TO NATIONAL

Washington, Jan. 3—Lieut.-Col. W. G. Wall, who was the chief engineer of the National Motor Car Co., Indianapolis, Ind., and who during the war has been in the Ordnance Department engaged in the design and construction of tractors and tanks, will remain in Washington until Jan. 15, at which time he will resign to return to the National company in his former capacity.

ALTITUDE RECORD AGAIN BROKEN

New York, Jan. 4—A world's record for altitude was made by an American pilot flying a British plane and carrying one observer. Jan. 2 Captain Lang, R. A. F., attained an altitude of 30,500 ft. in 66 min. 15 sec. The best previous record was made by Capt. R. W. Schroeder, an American pilot, who reached an altitude of 28,900 ft. Sept. 18, 1918, at the Wilbur Wright field at Dayton.

FINKENSTADT ALMOST THROUGH

Washington, Jan. 3—Capt. E. R. Finkenstadt, assistant chief of the truck section, Motor Vehicles Division, Quartermaster Department, who was formerly assistant to Christian Girl, president of the Standard Parts Co., will complete his work here by Jan. 10 and at that time return to the Standard Parts Co. Capt. Finkenstadt was for many months chief of the production of the class B standardized truck, officially known as the Liberty truck.

First European Post-War Show in March

Motor Cars Will Be Exhibited at Lyons—U. S. Firms Listed

PARIS, Dec. 4—The first post-war motor car show in Europe will be a portion of the Lyons sample fair to be opened in the Silk City March 1, 1919. To take care of car manufacturers, a special building has been erected in the fairgrounds for motor cars only, and the participation of car manufacturers is being encouraged by the French manufacturers' associations. The list of exhibitors which has already been got together shows that this section will be of considerable importance.

American firms listed are Goodrich and Overland. European manufacturers who will have cars on exhibit comprise the following: Berliet, Blum, La Buire, Chiribibi, Cottin & Desgouttes, Delage, Delahaye, D. F. P., Fiat, Hotchkiss, Panhard-Levassor, Rochet-Schneider, Schneider, Turcat-Mery, Unic, Lorraine-Dietrich, De Dion Bouton, Peugeot, Rolland-Pilain, Vinot & Deguingand. Many tire and accessory firms have booked space, among them Bergougnan, Nilmelior Magneto Co., S. E. V. Magneto Co., Zenith Carbureter Co., Dunlop Tire Co., Lavalette Magneto Co. and Oleo Spark Plug Co.

In 1918 there were 3182 exhibitors at the Lyons fair, and the amount of business transacted was $150,000,000. The 1919 fair will undoubtedly be the biggest ever held, for on Nov. 1 of this year 2103 firms had secured space, compared with only 978 twelve months previous. The exhibition is open to all Allied and neutral nations, and space can be reserved until the last day of December.

DEMOBILIZING AIR SERVICE

Washington, Jan. 3—No aviation supplies of any kind are being shipped to the American Expeditionary Forces and none will be. The air forces abroad are being demobilized as rapidly as possible. This information was made public here by General Peyton C. March, when he stated that "the air forces are being demobilized with the greatest rapidity and General Pershing has asked that no more aviation supplies of any kind be sent to Europe."

ANDERSON WITH ADVERTISER

Detroit, Jan. 4—Lee Anderson, lately vice-president of the Hupp Motor Car Corp., now is associated with the Theodore F. MacManus advertising agency, Detroit, beginning Jan. 1. With this new connection, he passes out of active participation in the manufacturing end of the industry, with which he has been associated for the last nine years. He will be connected actively with car and truck merchandising through several large accounts handled by Theodore MacManus. He became directly associated with car manufacture in 1909, when he was made assistant advertising manager of the Chalmers Motor Co.

Mr. Anderson succeeded Harry W. Ford as advertising manager of Chalmers and in 1915 joined Hupp. Since 1916 he has been vice-president of the Hupp corporation, in charge of sales, advertising and service. He will be succeeded in administration of Hupp sales affairs by Oliver C. Hutchinson, who joined the Hupp corporation in 1915 and has been, successively, supervisor of wholesale branches and sales manager. Previous to this he was connected with the old Rambler company and with the General Motors Co.

BUS PROMOTER ASKS $1,000,000

Chicago, Jan. 6—Roland B. Conklin, railway promoter of this city and New York, has brought two suits against Theodore P. Shonts, president of the Interborough Rapid Transit Co., claiming damages that aggregate $1,000,000. Mr. Conklin says Mr. Shonts violated his agreement to buy 55 per cent of the plaintiff's stock in the Chicago Motor Bus Co. and the New York Motor Bus Co. and charges that when the Chicago company applied for a franchise to operate in South Chicago the Chicago Stage Co., in which Mr. Shonts is interested, made a similar appeal and was successful. Nov. 27, Mr. Conklin says, an agreement was drawn up by which Mr. Shonts was to gain control of his competitor's lines but hostilities were carried on in spite of it.

EDSEL FORD HEADS PLANT

Detroit, Jan. 3—The resignation of Henry Ford as president of the Ford Motor Co. has been accepted and his son, Edsel B. Ford, elected formally president. Henry Ford will continue as a member of the board of directors and also as a permanent advisor. But he will devote practically all of his time to Henry Ford & Son's tractor business and also to his new weekly publication, known as the Henry Ford's National Weekly.

A dividend of 200 per cent, or $4,000,000, 100 per cent payable in January and 100 per cent in February was declared at the same meeting which saw the change in the presidency. The directors decided to increase the minimum wage of Ford employees, including not only the Highland Park plant but Ford plants all over the country, from $5 to $6 a day. The increase in wages will affect approximately 20,000 employees in the Ford organization. It was stated that the increase was due to a large extent to the fact that Ford workers remained loyal to the Ford Motor Co. during the period of the war when so many other plants in Detroit and elsewhere offered a higher scale of wages.

Several changes in personnel of the organization were announced at the meeting. William Ryan, formerly assistant sales manager, has been promoted to sales manager to succeed Norval A. Hawkins. The latter may give his attention to the foreign business of the concern. B. J. Craig, formerly assistant treasurer, has been elected secretary. P. E. Martin was appointed general superintendent.

Two-man tank coming over the top, showing type of crawler

U.S.A. Two-Man Tank Fitted With Motor Car Engines

Standard Units Used to Make Unusual Machine

WHAT it meant to co-ordinate the industries of the United States into a comprehensive working unit is a story in itself. How commercial products have been re-vamped into minions of victory would require volumes to tell in their entirety. Here is one instance of how this has been done that is typical, the Ford two-man tank, as it is termed by the civilian, or the 3-ton Special U. S. tractor, as it is listed by the Ordnance Department, an adaptation of the units employed in the construction of the Ford passenger car and truck, turned, without radical change, into a fighting machine of no mean proportions.

Status of Production

Very few of these tanks actually were produced. However, production Nov. 11 reached the point where it would have been 1250 for December and on the basis of 2500 a month by Jan. 1.

Briefly, this fighting unit may be described as a combination of two model T Ford powerplants, two halves of a Ford truck rear axle, inclosed in armor plate and suspended on two tracks of the crawler type. For armament a special Browning machine gun is mounted in the forward end.

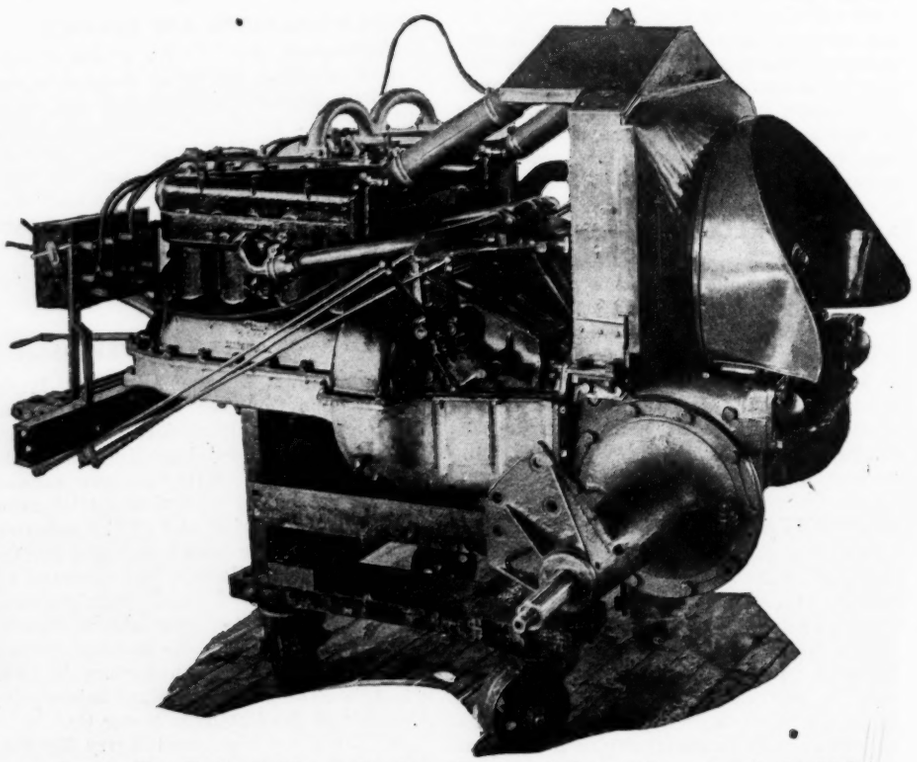
There is nothing especially new in the units employed, but there is an interesting story connected with the adaptation of these units. Here is a typical example of how American manufacturers have turned out war machines without any radical departures in manufacturing processes, and it goes a long way toward explaining how American manufacturing genius was able to produce machines of war in quantities which set European nations agog, even though America came into the war woefully unprepared, as the pacifists argued, and yet turned the tide within fourteen months after that historic April 6, 1917.

To get sufficient power for operating the 6200 lb. represented in the Ford two-man tank the designers decided upon two Ford model T engines, which theoretically gave one engine for each track. However, provision had to be made against the possibility of one engine becoming inoperative, which would leave the operator and gunner in a perilous position, since such a condition would make travel in any direction except a circle out of the question. To remedy this, a ring with teeth milled in its outer circumference was riveted to the rear of each flywheel and a smaller gear—one of approximately 8-in. diameter—meshed with these two larger gears, serving to lock the two engines together. This small engine-connecting gear distributes power to one or both tracks, and even should one engine misfire, or even cease to fire, the other engine distributes its power to both tracks alike.

Since the crankcase carries the lubricant for the connecting rods, transmission and clutch in one compartment, the flywheel of the model T Ford engine runs in oil, hence the necessity for a change in crankcase design to permit of a passageway between the two crankcases which would act as a housing with the engine-connecting gear. Half of this passageway is cast with each crankcase, which, except for the fact that there was no lower crankcase cover, does not differ in design from the usual Ford crankcase. The material in this instance, however, is aluminum instead of pressed steel.

With the powerplants of the tank located back of the driver, the question of cooling involved placing the radiator at the rear of the machine; consequently, the cylinder heads had to be changed slightly so that the outlet connections between the cylinder blocks and the radiator would point toward the rear instead of forward.

Whereas, ordinarily with the Ford powerplant, the thermo-syphon cooling is used, in this instance, greater cooling facilities being imperative, a water pump is employed with a larger radiator of special honeycomb design. Further, a starter and generator were installed so that, should the engines become stalled in passing through shell craters or over difficult places, the operator might start the engines again without the necessity of getting outside the tank and cranking. The generator has



Practically all the inside mechanism of the tank is a unit, removal of which leaves only the armor plate body

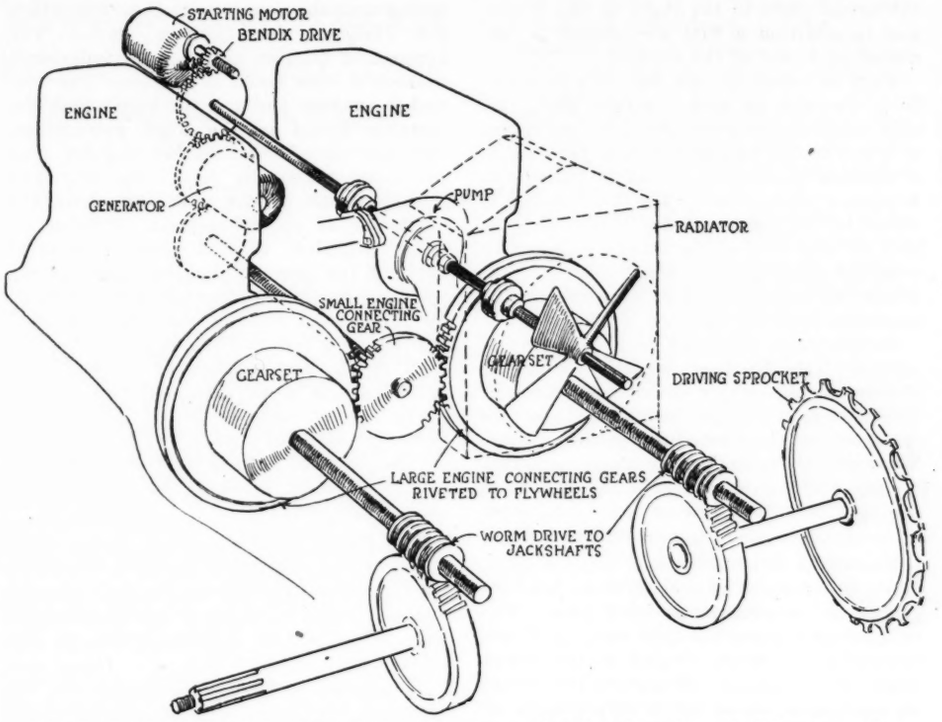


Diagram of mechanism of Ford two-man tank, showing location of different units

no function other than recharging the storage battery from which the current is taken by the starting motor and for ignition when the engines are being started. The usual Ford magneto, one for each engine, supplies ignition current except for starting.

Driving Pump and Generator

Now comes the interesting method of driving the water pump, fan, and generator. The engine-connecting gear, which heretofore may have been supposed to have completed its functions when it locked the two flywheels together, carried a shaft to a train of three gears of identical size, inclosed in an aluminum housing, mounted vertically at the extreme front end of the cylinder blocks, or just ahead of where No. 1 cylinder would be found on any passenger car. A boss is cast on each side of this gear-train housing and the housing is secured to the inside front ends of the two crankcases by bolts passing through the two bosses to the crankcase. The lower gear in the train is keyed to the shaft connecting it with the small engine—connecting gear. The middle gear of the train is keyed to the generator shaft, and its only function is to drive the generator. The top gear of the train is keyed to a shaft which extends rearward through the water pump, the rotor of which is pinned to it, and thence still further rearward through a rectangular passage in the radiator core to a bracket, in front of which is mounted the fan.

The generator is mounted on the rear of the gear-train housing and the starting motor on the front of the housing. The method of applying the power from the starting motor to the crankshaft of the two engines differs from conventional practice. Immediately above the upper gear of the train is the shaft that carries the Bendix pinion, this pinion having a housing cast integral with the rear half of the gear-train housing. The end of the Bendix pinion shaft toward the front carries a gear into which are meshed the teeth milled in the end of the starting motor shaft.

This gives sufficient gear reduction to allow the starting motor, mounted on the upper front of the gear-train housing, a high speed while revolving the crankshaft at a relatively low speed. The starting motor shaft carries a very small gear, meshing with the somewhat larger gear keyed to the end of the Bendix pinion shaft. When the starting motor begins operating it draws the Bendix pinion into mesh with the top gear of the train, which delivers the power to the middle gear, thence to the lower and then through the shaft to the small engine-connecting gear, which is constantly in mesh with the gears riveted to the two flywheels.

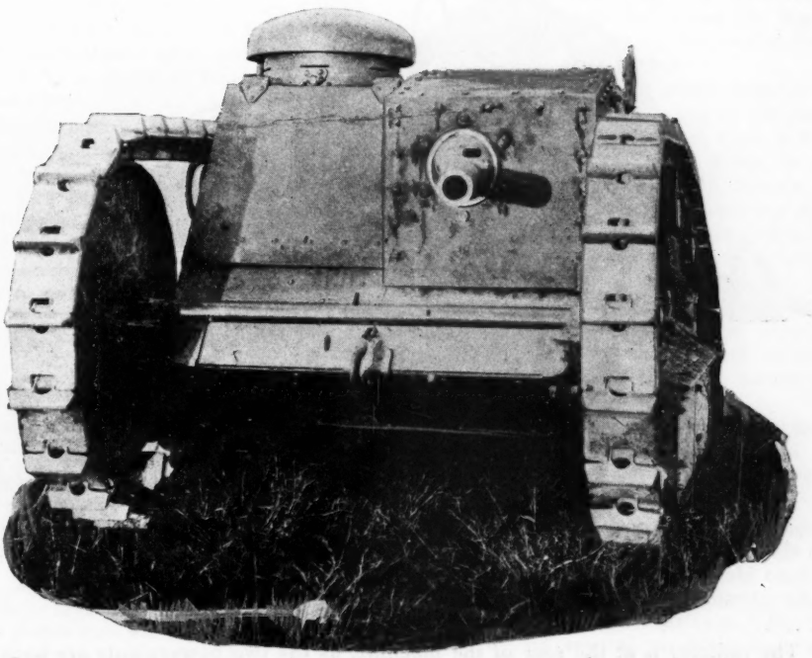
With the small engine-connecting gear about half the diameter of the two gears riveted to the flywheels it must turn twice engine speed, and since the gears in the train are of equal size they also turn at twice engine speed. This makes the shaft driving the water pump and fan turn as high as 3400 r.p.m. at times, consequently, the fan is friction mounted, adequate provision being made for adjustment to get the maximum efficiency from the fan.

Rear Axle Housing

The rear axle housing is cast in three parts—a center part which only serves to keep the unit in alignment, since it bears no load, and two ends, one right and one left, which carry the two transverse shafts that supply power to the sprockets mounted on the outer ends. The worm and gear are identical with those in the Ford truck. The front end of the shafts carrying the two worms was squared to receive the rear ends of the shafts carrying the clutches and transmission drums. The rear axle is bolted directly to the rear ends of the crankcases and transmission covers, and with the axle bolted to the unit powerplants the shafts join to furnish a positive drive to the two worms. The transverse shafts carried by the worm gear do not extend through the axle from end to end but only from the sprockets to the worms, one right and one left.

The radiator is mounted on the two worm housings, these forming a cradle in which is suspended the lower tank of the radiator. On the rear of the radiator a housing surrounds the fan, so designed that the air is drawn up through a screen from the bottom of the tank.

From the foregoing one can visualize the compactness of the powerplant. The two engines are locked together by a gear, and those familiar with the Ford engine understand that when one says "engine" that includes planetary transmission and clutch combined. With the axle housing carrying the worm gears bolted directly



Front view of two-man tank. The driver sits in the box with the gun

to the transmission housings, it will be seen that practically all the inside mechanism of the tank is a unit, removal of which means that only the armor-plate body remains.

It might be well, however, to say a word about the method of control. One domestic and one export transmission case were employed in this combination, so that there might be a right and left control without resorting to mechanical changes. The arms controlling the speeds—pedals in usual Ford construction—are at the rear end of the tank—back of the driver. Levers linked to these control arms through the medium of rods are mounted on the channel section, forming the front support for the powerplants. The driver's seat, which is on the right side of the tank immediately in front of the powerplants, has two levers on each side, one set for each transmission. One of the levers in each set controls reverse speed and has to be held in operating position much the same as the foot must be kept on the reverse pedal of a Ford. The other lever in each set controls high, low and neutral, that is, raised to its extreme upward throw it puts the transmission in low speed, like the forward pressure of the left pedal of a Ford, while a downward throw is equivalent to releasing the left pedal on a Ford.

Control of Tanks

A notched quadrant at the base of this lever carries a notch to hold the high-speed position and also a notch near the center of the quadrant which holds the lever in neutral position. The brake pedal in usual Ford practice is controlled by rods running to the feet of the driver, pressure being applied as with any ordinary brake. The brake, however, is for the transmission only, there being no other means of retarding speed. Spark control is by a lever mounted between the two cylinder blocks just back of the driver. A bracket is bolted to the front engine support, and the lever operates horizontally. Carbureter control is by a hand throttle mounted on the armor plate at the right of the driver, and in addition a foot accelerator is furnished as a part of the control.

Fuel is taken in the two intake manifolds through an arched intake pipe, this pipe approximating the shape of two halves of a circle with two of the ends joined into a common passage to which is bolted the Kingston carbureter. The carbureter is closer to the right cylinder block than the left, so that half of the intake pipe arches over the right cylinder head, and the other takes the same form but joins the intake manifold between the two blocks.

Exteriorally, the tank is a diminuative edition of the Brittania which paraded the streets of the major cities last summer. This two-man edition has an axle across the front end, bracketed to the armor plate. This axle has no load-bearing function, merely serving as an axis for the idler sprocket on either side of the tank, these idler sprockets operating on roller bearings.

The track is of the usual crawler type, being made up of cast-steel links held together by case-hardened steel pins. The roller frame assembly is a built-up U-section of sheet steel, riveted to the lower edges of the armor. There are six rollers on each side, made up in two groups of three, each group being mounted on the hypotenuse of a triangular section of sheet steel, the angles formed by the base and the perpendicular sides of the triangles being mounted on the two ends of a leaf spring similar to that used on the rear of the Ford car. This spring is mounted on a stud which permits oscillation so that the rollers can conform to the contour of the ground over which the tank travels. Supporting the upper track between the two sprockets is a leaf spring similar to that used by the Ford in front, except that it is inverted, the ends of the spring being fitted with idler rollers to hold the track in tension. This spring also is mounted on an axis so that this group may oscillate.

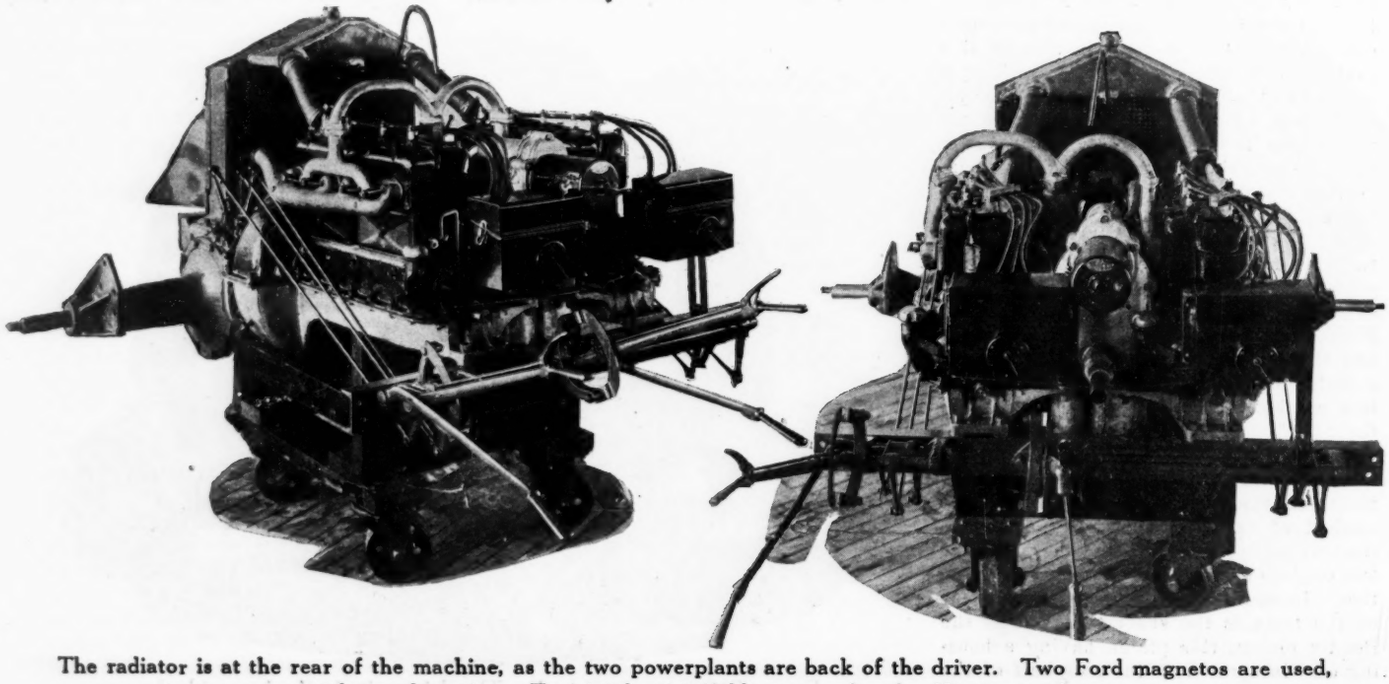
The method of control differs, perhaps, more from the usual control of the track-laying ordnance equipment than any other job designed for fighting work. The absence of friction clutches for individual control of each track is notable. The control is entirely through the two regulation clutches found in the Ford powerplant. The method of starting the engines does not differ materially from that employed in any motor mobile unit, but there the similarity of operation ends. Holding of either high-low control lever in neutral cuts off the power from the track driven by that particular transmission cotrolled by the lever. Placing one high-low control lever in low and leaving the other in high is the best method of turning, and in no case is it advised that one control be in reverse and the other forward for turning. With one track cut out entirely, all the power of both engines is distributed to the opposite track through the small engine-connecting gear.

Armor Forms Body

The armor forms the body of the tank. Its thickness ranges from ¼ in. to ½, the heaviest gage being on the sides and ends and the top and bottom being of the lighter gage.

The machine gun operator sits on the floor of the tank, the gun being ball-mounted in front of him. Holes are provided from every angle for revolver shooting, armor plate coverings being fitted to close these holes when not in use. The dome of the tank, the walls of which are hexagonal, is directly over the driver's head. Slots are cut at the base of each section of the hexagon, and inside are fitted revolving plates through which are cut various-sized holes. By turning these plates the driver can see through three different-sized openings.

The average speed in high is 10 m.p.h. Dynamometer tests show the powerplants to give a horsepower of 34 at maximum engine speed, or approximately 1700 r.p.m. The completed tank weighed approximately 6200 lb. Its overall length is 13 ft. 10 in. and its height about 5 ft.



The radiator is at the rear of the machine, as the two powerplants are back of the driver. Two Ford magnetos are used, one for each engine. Two intake manifolds are used and a Kington carbureter

Ought to Know Tractors

Farmers Should Be Able to Tell Whether Work is Right, Says One

Line of Advice From an Experienced Man

KANSAS CITY, Mo., Jan. 3—"I see we farmers will have to know enough about tractors to tell when the repairmen are doing the right things, and keep them from jimming the works," said a farmer-owner in Kansas City recently.

"We'd a whole lot rather give the local dealer or garageman the job of fixing the tractor—but some of us have become skittish of the repairman. Last summer my tractor wouldn't work—held me up several times during plowing and harvesting. The trouble was in the water system. The repairman found that out, all right, but he couldn't fix the tractor so that it would stay fixed. Run a day or so, and then go bad again.

"I've been studying water systems myself the past few days, and the next time a repairman starts to work on my tractor, I'll know what he ought to do. My tractor is going to work next year, and don't you forget it! I know what was wrong with that water system. I believe I can fix it myself.

"We farmers don't want to call on the manufacturer's branch house to send out a service man when something goes wrong. Gee whiz! Don't we know the time it takes for a service man to get from Kansas City to our farms? Don't we know what it costs? Can't we see that we are losing a lot more money than the mere cost of the repairs?

"But after a few experiences of waiting till the garageman has torn the engine apart, or busted up something that shouldn't have been opened at all, and then having to send to the branch house—we begin to see that we have to learn our tractors ourselves.

"I'm taking several hours off this winter to study the instruction books issued by the manufacturers, and I'm going to all the tractor short courses I can spare time for.

"I'm doing a little loafing around the garages in my district, too, finding out whether the repairmen really know anything about tractors or not.

"And I've doped out a line of advice that I am passing along to farmer friends.

"Buy of a dependable manufacturer, the right kind of a tractor for your work.

"Learn all about this tractor, especially how to tell when it is running right and what is wrong when trouble comes.

"Buy only from a dealer who is equipped to extend service and who is willing to provide service.

"Keep acquainted with the dealer, visit his shop occasionally and have him come out to your place to look at your tractor once in a while.

"Find something for the tractor to do every month in the year, so that you can be sure it is always in shape to operate, and be prepared for the jobs in which it is essential."

IOWA TO TEACH TRACTOR

Des Moines, Iowa, Jan. 4—Iowa farmers are to be taught to get the most service out of their tractors with the least amount of repairs, fuel and delays. The state college at Ames will conduct a series of two-week courses in care and use of the tractor. Members of the engineering faculty will have charge of the courses, which will cover construction of engine, ignition, carburetion, cooling, lubrication, clutch, transmission, frame and bearings and instruction in operation, adjustment, location of trouble and repair work. Laboratory work as well as lectures will be given. The only cost to the men taking the courses is $7 for gasoline, oil and laboratory expenses.

The first course opened Dec. 30, to be followed each two weeks until five two-week courses have been completed.

OHIO PLANS TRACTOR SCHOOL

Columbus, Ohio, Jan. 3—The second annual farmers' tractor school of the Ohio State University College of Agriculture will be held here Jan. 27-31. About twenty-five tractor companies will be represented. Tractors and accessories will be shown, and demonstrations will be held in the laboratories of the school of military aeronautics. Ten lectures will be given by prominent agricultural engineers in addition to those by the college staff.

Two thousand students registered last year at the school, which is held in connection with farmers' week. Each exhibiter will submit his tractor to a Prony brake test, in accordance with rules recently agreed on by a group of tractor company representatives. Fuel will be weighed during every 10 min. of the test, and a check will be made each 10 min. to tell the number of revolutions of the Prony brake wheel. The performance of each tractor is to be posted on a bulletin board.

In addition to the farmers' week demonstrations and lectures, a two-week tractor course will be held immediately afterward, ending Feb. 14. No fees will be charged, and 300 students will be accommodated.

He Can't Get Along Without It

ATHENS, GA.—Editor Motor Age—I had you to mail me a copy of Motor Age in September, and I have decided that I can't get along without it and run a successful automobile business. There are so many things upon which I need information, and I find that the only source from which I can secure it is from the Motor Age.

So you will please start my magazine at once, and oblige—Emmet J. Hale.

P. S. I believe I have lost by not taking the Motor Age when I first entered the automobile dealers' field this year, for I could have gotten valuable information "first hand."—E. J. H.

Highway Work Goes On

Iowa Is Out to Develop Motor Truck Peace Transportation

One Fleet Covers Sixty-Five Towns

DES MOINES, Iowa, Jan. 4—The seed of motor truck transportation has found fertile ground in the soil of Iowa. This state now seems about ready to go into the rural express business on a considerable scale.

The state council of national defense is fathering the project and has divided the state into five districts, each with a chairman in charge appointed by the Highway Transport Committee of the Council of Defense.

The aim of the council is to organize in the principal centers corporations of local moneyed men to finance the companies to engage in motor transportation on a large scale. J. D. Eggleston, Mason City, Iowa, is chairman of the special committee of the council of defense, and Mason City was a pioneer of Iowa in starting the actual working companies.

Dubuque is among the cities of the state which have taken the lead in the project, and already a corporation has been organized there with a capital stock of $100,000 and is operating a fleet of trucks over twelve routes and visiting sixty-five towns daily.

Trucks Ply Daily

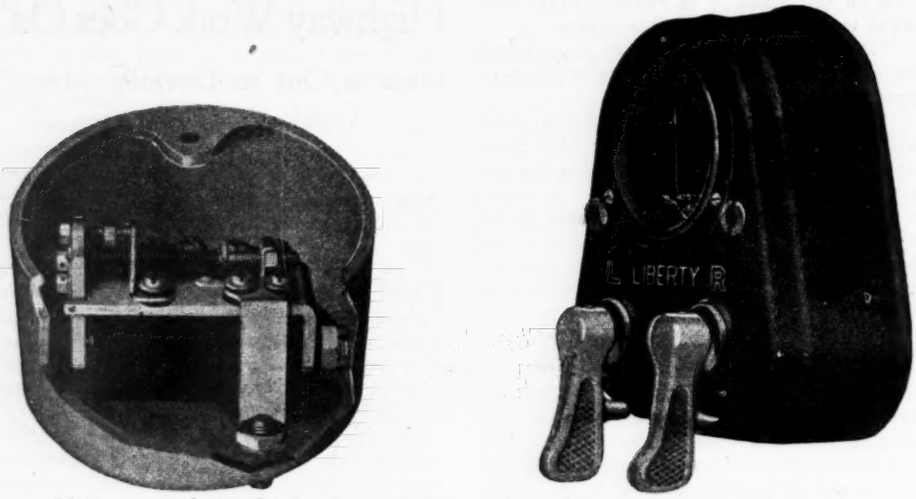
Council Bluffs has several trucks plying daily between that point and Omaha and other towns within a radius of 85 miles. The Council Bluffs companies have met a particularly hearty support from the farmers of southwestern Iowa and since Jan. 1 this year have moved 158,000 head of hogs, 18,488 head of cattle and 37,130 head of sheep.

Sioux City is operating nine routes serving sixty-four towns daily, and the Mason City service extends over five routes from 90 to 150 miles in length.

Figures which give the motor transportation a very favorable standing as compared to freight hauling are gained from a trial trip made from Mason City, Iowa, to Albert Lea, Minn., a round trip distance of 84 miles. A ¾-ton truck carrying 2800 lb. and a 1½-ton truck carrying 3300 lb., made the round trip in a driving rainstorm in 6 hr. 40 min. The expenses for the round trip for both trucks, including overhead, depreciation and interest charges, were $24.80, whereas the expense of regular freight haulage of the same amount of tonnage would have been $41.40.

At present 200 trucks are operating daily over established routes in Iowa, and approximately 170 more are operating regularly but not on a daily basis.

Mr. Eggleston is now spending most of his time in Des Moines organizing this district, but the project is being held back on account of the influenza epidemic which has prevented public meetings. He has spoken before several meetings here and met a ready response.



Voltage regulation back of switch, left, and combination switch and ammeter

Ignition on Liberty Engine

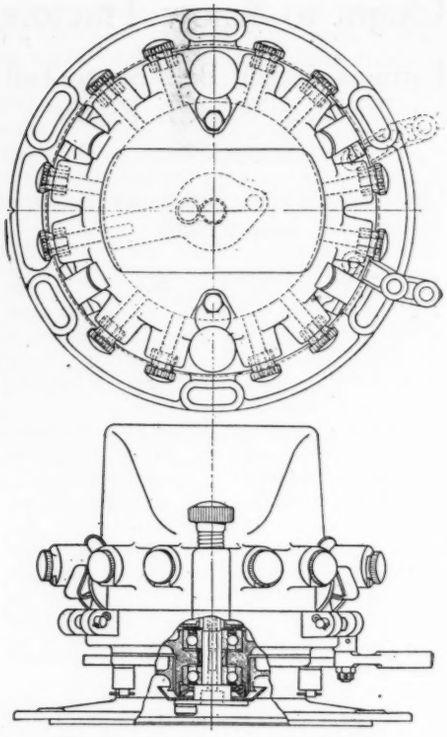
Special Delco System Is Used

THE generator-battery type of ignition is used on the Liberty airplane engine. A special Delco system was developed. This consists of low-voltage generator, voltage regulator, extremely light-weight battery, double-distributer system, duplex switch and the various units necessary for control.

The generator is driven from the vertical shaft, which also drives the oil and water pumps. The regulator is so designed that it keeps the voltage between 10 and 10½ volts. The generator operates in conjunction with a special light-weight Willard or Exide 8-volt battery which supplies electrical energy for starting and while idling at low speed. About 650 r.p.m. of the engine the generator supplies all the current required for ignition and charges the battery.

The ignition system is double, there being two spark plugs in each cylinder, as well as duplicate distributers, which latter are mounted upon the camshaft housing of the engine and driven directly from the camshaft. The two distributers are ingeniously synchronized. Each cylinder receives sparks from both distributers, the right distributer supplying the plug nearest the distributer and the left distributer the plug nearest the propeller.

The current is controlled through a duplex switch. Either switch lever, when used alone, causes the battery to supply the ignition current. When both switches are turned the generator automatically is connected in circuit. As the generator does not furnish sufficient current to carry the ignition load, when the engine is running at less than 650 r.p.m., it is not advisable to turn both switches on at such speeds, since this causes the battery to discharge through the generator. Thus, starting is accomplished by turning one switch handle, and when the engine is running at above 650 r.p.m. the second switch lever is turned to the "on" position, so that the current then will flow from the generator. An ammeter is incorporated in the switch assembly.

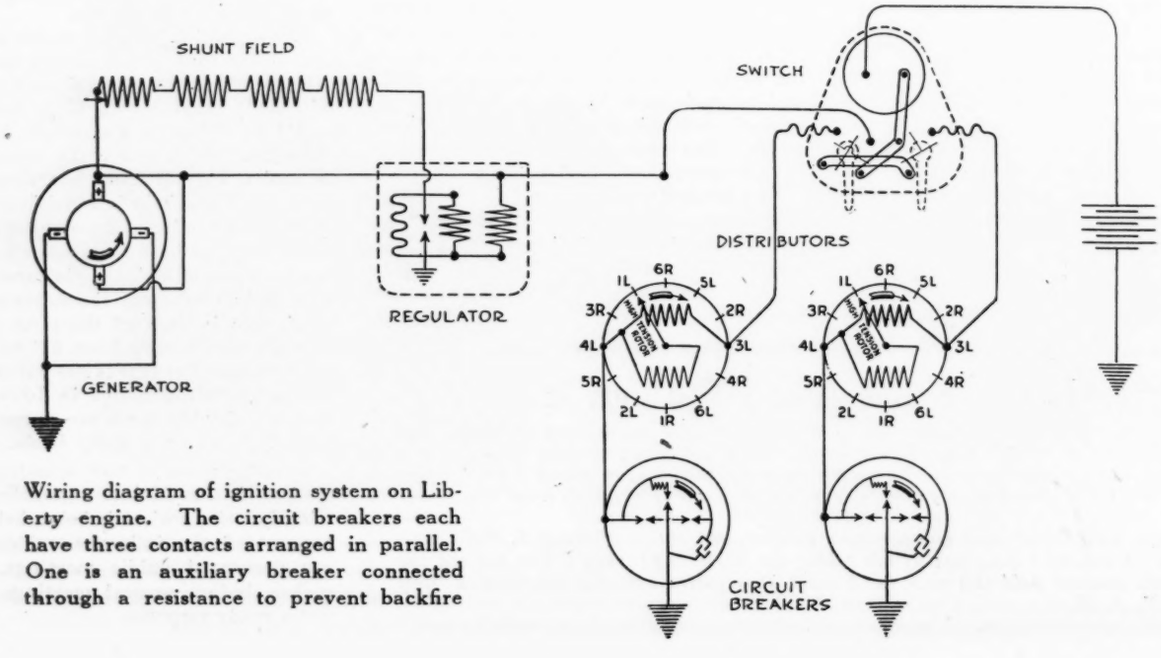


The ignition unit on the Liberty

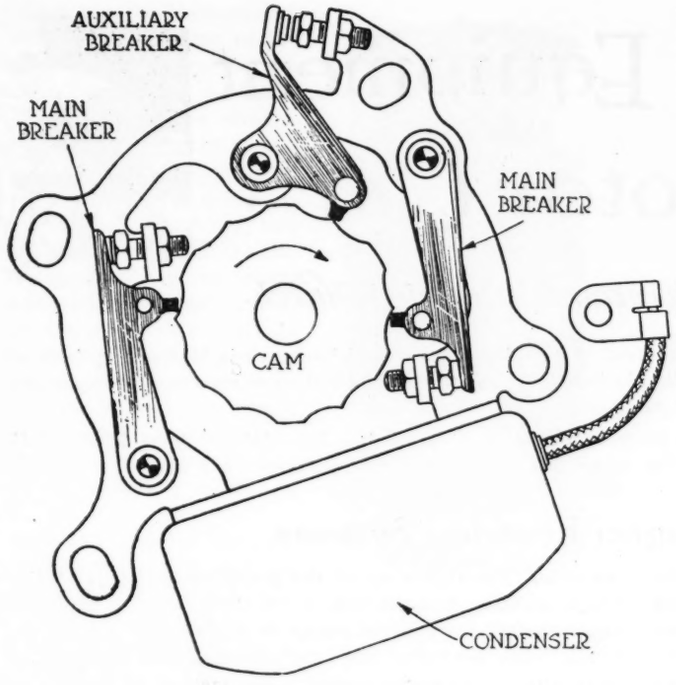
The generator is a four-pole, shunt-wound unit, mounted vertically on the engine crankcase. The tachometer drive is incorporated in the generator base, being secured by a worm gear off the armature shaft.

The voltage regulator controls the generator field current through the magnetically-operated regulator contact points. This regulator usually is mounted on the dash directly behind the switch.

Probably the most interesting unit in the entire system is the breaker-distributer. Two distributers, each operated by the camshaft as described, provide each cylin-



Wiring diagram of ignition system on Liberty engine. The circuit breakers each have three contacts arranged in parallel. One is an auxiliary breaker connected through a resistance to prevent backfire



Arrangement of the three arms of circuit breaker

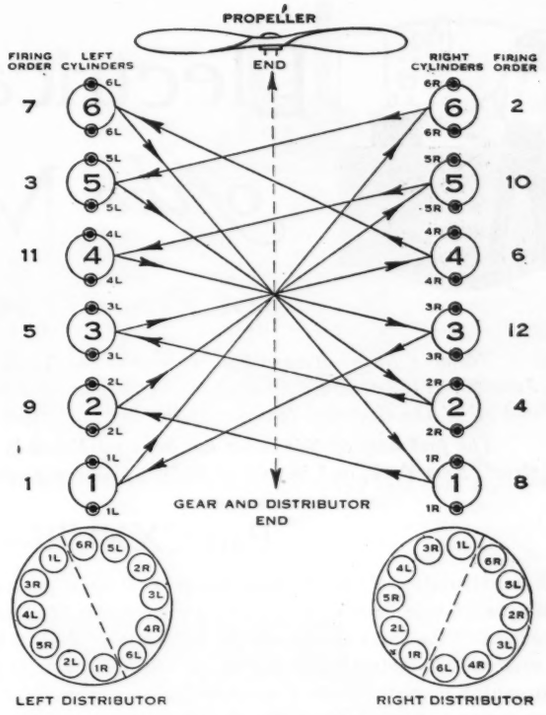


Diagram of firing order for Liberty engine

der with two independent and simultaneous sparks at the duplicate plugs. The distributers are interchangeable, and each distributer incorporates both an ignition coil, sealed in the Bakelite head, and the breaker mechanism. The timing range is 40 deg. —30 deg. advance and 10 deg. retard— measured on the crankshaft circle.

Both breaker mechanisms are operated by cams having twelve lobes, or one lobe per cylinder. The cam operates pivoted contact arms which close and open the low-voltage circuit at the proper instant for firing. The unusual features of the breaker mechanism are the two main contact arms, each performing the same function at the same time for reliability, and, as a safety feature, an auxiliary contact arm which prevents the engine from operating in the reverse direction.

The auxiliary contact arm is so set that when the engine is running ahead the auxiliary contact points break before the main contact points, so that the action of the auxiliary contact points has no effect whatever. Should the engine begin to rotate backward, the auxiliary contact points will not separate until after the main contact points have separated. Since the auxiliary contact points are connected in series with a resistance, the current after the main contacts are broken is so weakened that no spark will result and the engine, therefore, cannot function in a reverse direction.

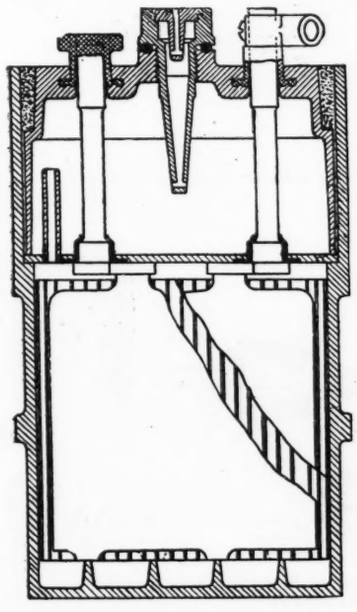
It is, of course, necessary in this arrangement that the two pairs of main contact points operate simultaneously to get synchronized sparks. To provide for synchronizing adjustment, the condenser-breaker plate, upon which the contact arms are pivoted, is arranged to swivel slightly, permitting as an adjustment feature one arm to advance before the other in their relation to the cam. This adjustment is secured by a clamping nut on the left side of the plate. In adjusting the main contacts for simultaneous action, it is necessary that they are on the lobes of the cam at the same instant, and that the gaps between the contact points should be approximately the same. These contact points should be set so they separate not less than 0.010 in. or more than 0.015 in. The average opening is 0.012 in.

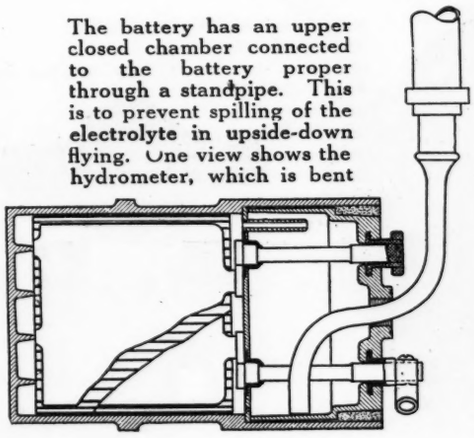
An ingenious maintenance arrangement has been worked out to check the accuracy of synchronism by two 8-10 volt electric lamps, each in series with one of the main contact arms. The cam should be turned one complete revolution and the lamp should indicate the best average of synchronism.

The firing order is as follows; the cylinders on the distributer end being referred to as 1L and 1R respectively and those at the propeller end as 6L and 6R:

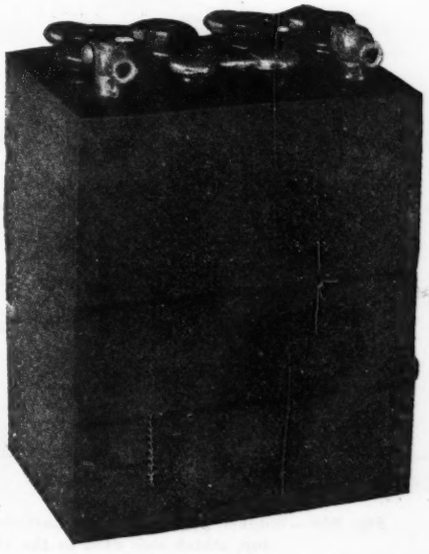
1	2	3	4	5	6	7	8	9	10	11	12
1L	6R	5L	2R	3L	4R	6L	1R	2L	5R	4L	3R

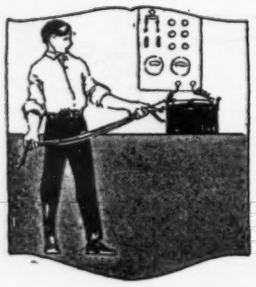
(*Concluded on page* 39)



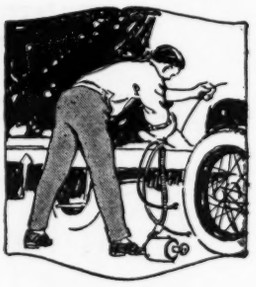


The battery has an upper closed chamber connected to the battery proper through a standpipe. This is to prevent spilling of the electrolyte in upside-down flying. One view shows the hydrometer, which is bent





Electrical Equipment of the Motor Car



By David Penn Moreton & Darwin S. Hatch.

Editor's Note—Herewith is presented the 128th installment of a weekly series ar articles begun in MOTOR AGE, *issue of June 29, 1916, designed to give the repairman and motorist the knowledge which will enable them to care for and repair any and all of the electrical features of the car, no matter what make or model it may be.*

The first half of this series has been published in book form by the U. P. C. Book Co., Inc., 243-249 West Thirty-ninth street, New York, and is sold at $2.50. The remainder of the series will be published as a supplementary volume.

Part CXXVIII—Wagner Electrical Systems

THE construction of the starting motor and back gear for the Wagner 6-volt, two-unit, two-wire system for 1914 and 1915 are practically the same as that in the system described in the previous section. The starting motor is connected to the engine by a chain which operates from a sprocket on the back shaft of the starting motor to a sprocket on the engine shaft. An over-running clutch prevents the engine from driving the starting motor.

The starting switch is of the push type and is mounted on the under side of the toe board within easy reach of the driver.

The generator is a four-pole, shunt-wound machine, and its output is regulated by the third-brush method. A view of the generator and cutout with their covers removed is shown in Fig. 658. In the 1915 systems the cutout was located in the tool box under the driver's seat. The generator used with this system is shown in Fig. 659. The brushes H and I collect the main current from the commutator of the generator. The brushes F and G supply current to the shunt field winding. The position of the brush G may be changed by loosening the screw U and moving the brush in the direction necessary to bring about the desired change in generator output. The adjustment in the position of this brush should be made by an experienced man.

1916-1917-1918 Wagner Systems

The generator in the Wagner 6-volt, two-unit, single-wire systems for 1916-1917-1918 is a round frame, two-pole, shunt-wound machine. The regulation of the generator output is by the third-brush method. The position of the third brush is adjustable, and the output of the generator may be adjusted by moving the third brush. The generator has only one insulated terminal, as it is used with a single-wire system. The method of driving the generator will depend upon the particular installation and may be by silent chain, train of gears, etc.

The cutout is cylindrical in form and is provided with two insulated terminals. The shell of the cutout forms one terminal of the shunt winding, and it must be well grounded. A view of the cut with the cover removed is shown in Fig. 660. Its operation

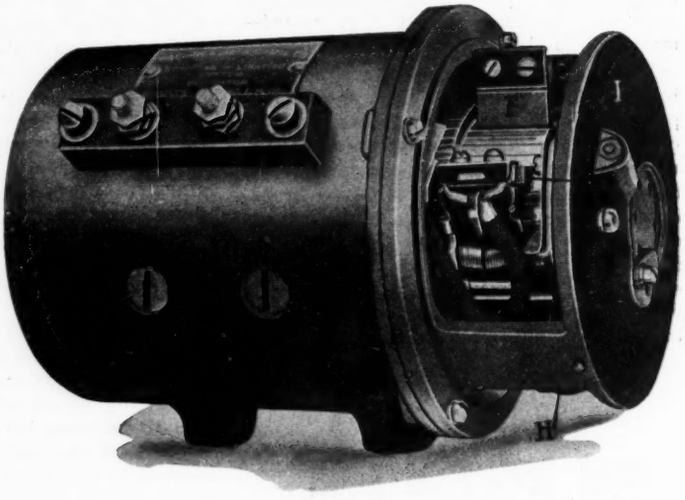


Fig. 659—Wagner generator used with the 1915 systems

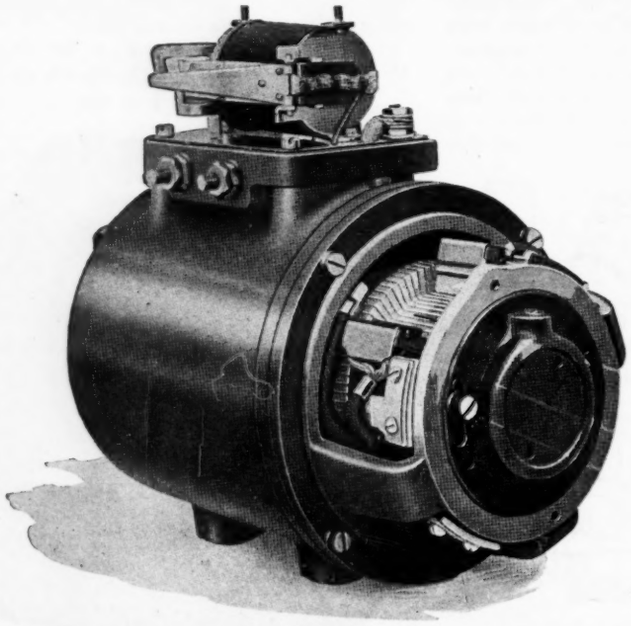


Fig. 658—Wagner generator with automatic cutout mounted on top, which was used in the 1914 systems

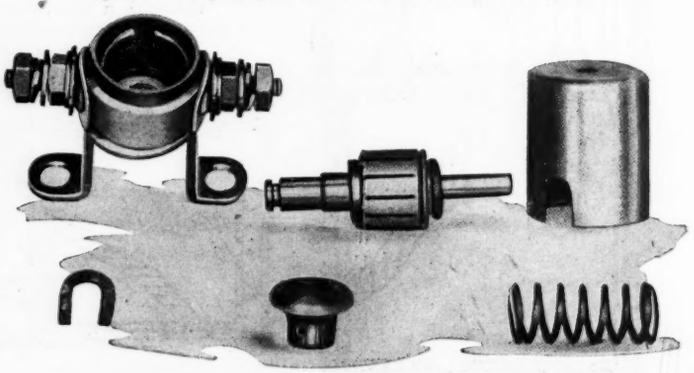


Fig. 663—Exploded view of Wagner starting switch installations

is as follows: When the current in the shunt winding has increased to a sufficient value, due to the increase in the voltage of the generator, the disk O is drawn toward the core of the electromagnet and the contacts Q and P close. As soon as these contacts are closed the generator starts to charge the battery, and the magnetizing action of the current in the series winding assists the magnetizing action of the current in the shunt winding. If for any reason the battery starts to discharge, the contacts Q and P are separated and the circuit between the generator and the battery is broken. The contact close at an engine speed of 7 to 10 miles per hour.

In some installations the generator is mounted on end, with the commutator end on top. A generator whose construction is such that it may be mounted on end is shown in Fig. 661.

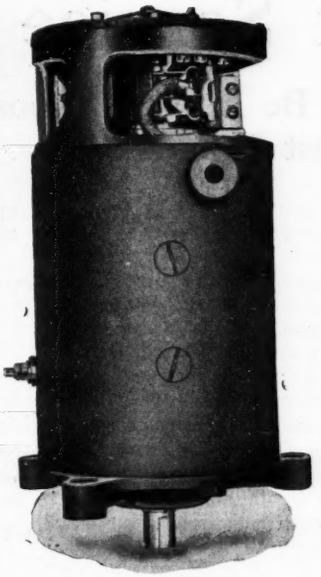


Fig. 661 — Wagner generator so constructed that it may operate in a vertical position

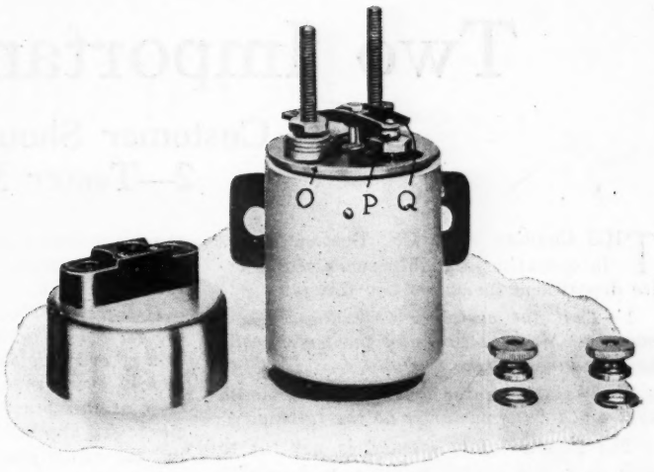


Fig. 660—Wagner electromagnetic cutout used with the 1917 installations

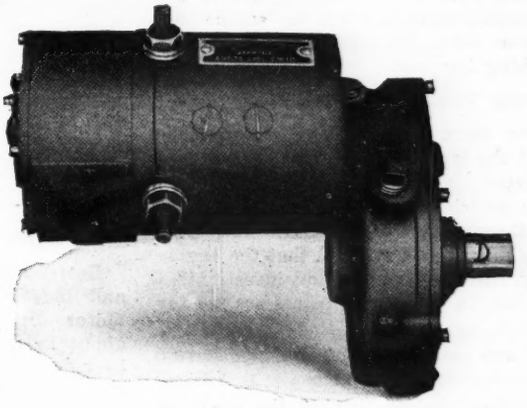


Fig. 662—One of the latest models of the Wagner starting motor

The starting motor is a four-pole, series-wound, four-brush, two-terminal machine. A pinion on the motor shaft meshes with a large gear which may form part of the Bendix screw mechanism, or it may be mounted on a shaft carrying a chain sprocket. This sprocket may be connected to a second sprocket on the engine crankshaft by a silent chain and over-running clutch. The starting motor shown in Fig. 662 drives the engine by a silent chain which runs over a sprocket mounted on the shaft D. The Bendix gear may mesh with a gear on the flywheel or it may mesh with a gear mounted on the end of the generator shaft, the generator being connected to the crankshaft of the engine by sprockets and a silent chain.

The starting switch is mounted under the floor board in the majority of cases and is of the thrust type. An exploded view of a starting switch is shown in Fig. 663.

Wiring of Saxons

A perspective wiring diagram of the Wagner installation on the Saxon six is shown in Fig. 664. This is a single-unit, 6-volt, single-wire system with the positive side of the system grounded. The taillight, headlights and horn are protected by fuses mounted on a fuse block located on the dash of the car. The lamp circuits, except the dashlamp and the ignition, are controlled by a combination ignition and lighting switch.

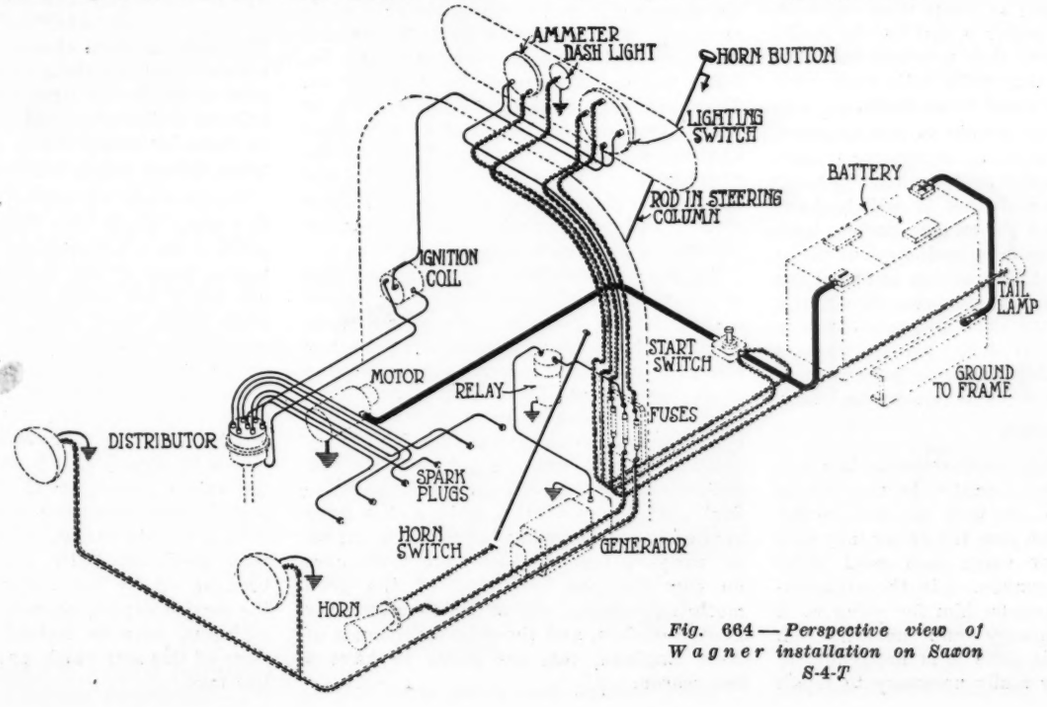


Fig. 664 — Perspective view of Wagner installation on Saxon S-4-T

Two Important Service Rules

1—Customer Should Be in on Diagnosis
2—Tester Must Not Talk

THE Cadillac Auto Co., Boston, Mass., in operating a highly successful service department insists on two things:

1—*That the customer be induced whenever possible to accompany the tester while he is diagnosing the troubles.*

2—*That the tester must keep his mouth shut and let the customer do the talking.*

The reason for this stand is not far to seek as a few actual examples will quickly show: Mr. A brings his car, with the information that the starter does not work well, and slips away before a tester can verify the statement. Later the tester gets behind the wheel, puts his foot on the starter and to his astonishment it whirls the engine over at a great rate. He tries it again and the same thing happens.

Something Wrong in Diagnosis

Clearly there is something wrong. He looks at the tag and notes that he has read it correctly. Next time he tries it with the ignition switch on and a glimmer of light breaks through the fog—he notes that while the cranking system is O. K. that the engine does not take hold readily and investigation shows that the spark plug points are too far apart.

So it was ignition trouble and not starter trouble.

It is quite obvious that all the customer knew about it was that he had difficulty in starting the engine, and that he wanted it fixed. So, after conferring with the superintendent, the ignition system is touched up, and later, it proves, the customer is quite satisfied.

Mr. B brings his car in with the complaint that the spring shackles in the rear are exceedingly noisy and he wants them replaced. He also departs before a test can be made. Investigation shows that they are worn but test proves that they make little noise compared with the internal brake shoes.

There are several pitfalls in this situation. If the request he made is religiously carried out, it will not be long after the car is delivered to him before he will be back with the news that the trouble has not been fixed; naturally he is quite indignant about it. He is likely to blame the company for not being on the job, etc., etc. The truth, however, is that the work he requested done was done and well done, but he made a mistake in thinking the main noise was in the shackles instead of in the brake bands.

May Be Mind Reader

If the man in the service station is a sufficiently expert mind reader, he may repair the brake shoes as well as the spring shackles. In which case the owner may congratulate him for using such good judgment, if he has confidence in the organization, or he may censure him for doing work that was unnecessary and unauthorized. After the work is done it is impossible to prove that it was really necessary to repair the inner brake shoes, and in one sense he is perfectly right if he refuses to pay for the extra work.

It therefore should be perfectly plain that the customer should give a signed authorization of every detail of work done on the car. Nearly every repairman admits the expediency of this practice. But this is not sufficient. To absolutely prevent misunderstanding the owner should accompany the tester.

Let us assume first of all that the owner makes his own diagnosis, which is written down on a shop order by the foreman or superintendent or a special man designated to do this work and that the owner signs it. When it comes to actually following out the instructions given by the owner it is found that his list of troubles is far from correct or extremely incomplete. To repair any of the necessary items not listed is to run the risk of his displeasure; yet not to do them is to call down his censure if he takes the stand that he brought the car in to have it fixed up and yet when he comes for it he finds that it is far from in good working order.

Second, let us assume that the owner brings the car in with the complaint that it lacks power, that the tester takes the car out while the customer waits around. When the tester returns he makes out a list of what he finds is wrong and this is turned over to the customer, who signs it without question. Perhaps he stops to read the list over, but unless he is technically informed, it means little to him.

What Tester Found

The tester found that the valves needed grinding, the carbon must be burned out, the carbureter needed adjusting, ignition required some attention and so on. When the work is done and the customer receives the bill he is astonished at the size of it; it was twice as much as he expected. A ride with the tester plus a thorough explanation of what had to be done to the car would have saved this misunderstanding.

The danger in allowing the customer to accompany the tester is that the latter will put his foot in it by talking too much. For example, Mr. C has a car which he has taken good care of and which has given him long service with practically no trouble. Mr. C, however, it must be explained, is not any too fastidious about the condition of his car, the main thing being its ability to run. But the tester knows nothing of Mr. C's idiosyncrasies. They go for a short ride together. By way of promoting conversation as well as seeking a compliment, Mr. C is just about to remark, "She's a pretty good old bus, isn't she?" when the tester blurts out, "Gee, this tub is in terrible shape; you oughta hav'er thoroughly overhauled."

Very true, perhaps, but terribly tactless. Not only is there chance of offending the customer but the abruptness of the information which is exactly contrary to what he believes is his own good judgment is likely to shake his confidence.

What Owner Doesn't Know

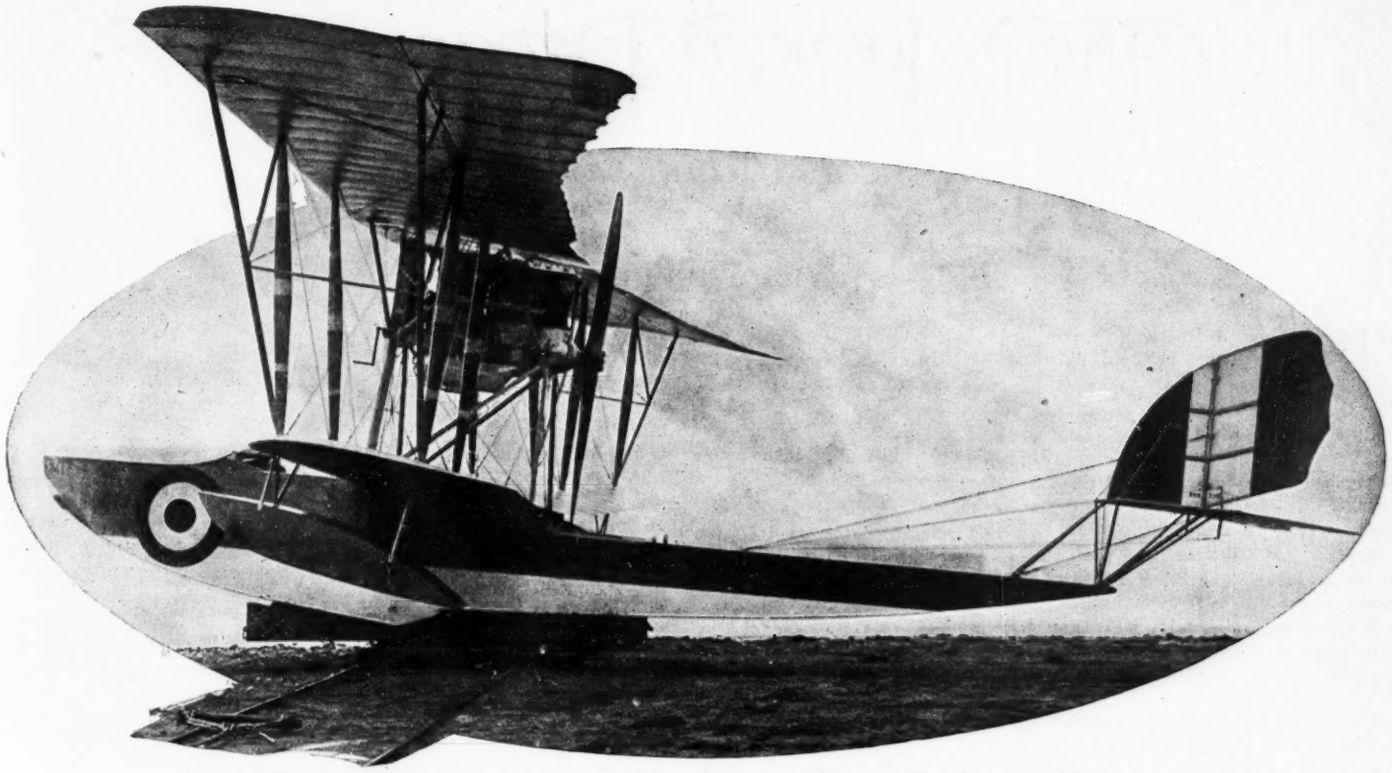
Furthermore the expert tester is likely to find many things that might be done to improve a car's performance which do no particular harm if left undone and which will not worry the owner, because he does not know about them, until the tester suddenly supplies the information. For example, the owner might bring his car to the service station for the location of one particular noise which happened to annoy him. To call his attention to three or four other rattles or to suggest that he might as well have the valves ground or the bevel pinion adjusted, even assuming that they required it to a certain extent, might do more harm than good, especially when the matter is brought up by the tester rather than by the service superintendent, who should be a diplomat, born or trained to handle situations of this sort which may call for more or less tact.

GOOD BUSINESS IN SIGHT

Boston, Mass., Jan. 3—The uncertainty and indecision which hovered about the motor district in Boston among people about to buy cars, who were holding off because they expected to see prices drop is disappearing. During the last few days the inquiries and callers again have become normal, and sales are being booked for future delivery.

But most of all the effects of a settled policy is being felt by the dealers in disposing of their used cars. The demand for these machines has been growing steadily. Many people realize now that there will be a shortage of cars in the spring, and they are stepping in and picking out cars while there are some good ones left. Then there are the people who gave up motoring because it was not patriotic with a war on. They are back looking for cars, new or used. One of the big dealers said that Christmas week he expected to sell an average of one car a day. Monday he sold fifteen, Tuesday eleven, Wednesday he was closed, and on Thursday he sold six, or thirty-two used cars in three days.

Another factor that will cause the sale of many used cars, particularly the lighter makes, is the electric railway situation. The fares have been jumping, and now they charge 8 cents and are asking permission to charge 10 cents for a single fare. That is the highest street railway fare in the country. On top of that the service is very poor. So anyone who can get hold of a few dollars next spring will get a car. And the fact that the winter is mild and a good part of it gone now has led many to expect an early spring, so they have their eyes on cars for the beginning of the good motoring season. All of which means the Boston dealers, and those in other parts of New England, too, are going to have a fine season.



One of the huge flying boats developed during the war. This is a Macchi. Note the eye effect

A 110-Volt Automatic Farm Power and Lighting Plant

WHAT the makers claim to be the first successfully operated 110-volt automatic electric farm power and lighting plant at a low price is manufactured and sold by the Automatic Light Co., Inc., Minneapolis, Minn., and is named Alco.

This plant is a light, compact unit. The engine is the Alco design and is exceedingly simple and accessible. It is a single-cylinder, four-cycle, valve-in-head type, water-cooled by a special percolator system that requires only 4 gal. of water.

Special Generator Design

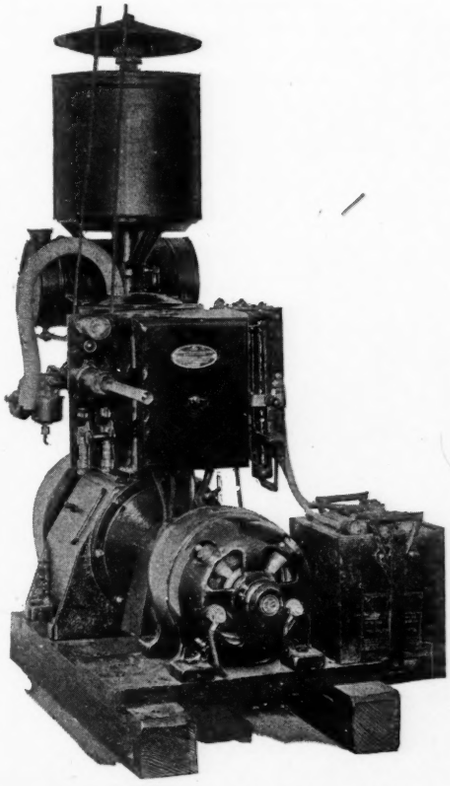
The generator is a special design made under Alco patents by the General Electric Co. It is duplex-wound, having 110 volts on the power and lighting end and 7½ volts on the other end, which is used as a motor, from the 6-volt battery, in starting the plant. When the engine starts, the 110-volt end comes into action and the low end then becomes a generator which keeps the starting battery charged.

The battery is used only for starting the engine, and carries none of the power load. It is a standard 6-volt starting battery.

The switchboard consists of a relay and two electromagnets, also an automatic cut-out of simple design to protect the battery in case the gasoline tank is empty.

When any light or power is turned on anywhere on the farm, it closes the circuit of the relay and this in turn closes the switch on the starting motor which starts the engine. When 90 volts are reached, the 6-volt current cuts out and the 110-volt cuts in. This operation reverses when the last light or power is turned off and plant then stops.

Voltage regulation is a novel feature of the Alco plant. This is accomplished by an electric solenoid governor which acts directly on the throttle of the carbureter without any intervening cams, levers, or springs, opening and closing it to take care of the slightest variation in voltage, thus producing a steady, white, flickerless light direct from the generator and with high fuel economy.



Alco farm power and lighting plant

Some of the advantages its makers claim for the Alco are the standard voltage of 110 which permits the transmission of current at nominal loss to a distance of 1000 to 2000 ft. Also, for ordinary buildings and distances, only about a third of the copper is necessary. All lamps, motors and other appliances are standard 110-volt, which means less cost to buy and greater ease of repair and replacement. The elimination of the storage battery in the lighting circuit means lower first cost, lower upkeep cost and the consequent saving of their eventual renewal.

Overload Does Not Hurt

One important feature the Alco makers' claim is that the generator cannot be injured by overload. Although the rating of the generator is 750 watts, tests have been repeatedly made where as many as 2500 watts of load have been connected and at no time have any ill effects been noticeable, except a dimming down of the light owing to the consequent lowering of engine speed.

The Automatic Light Co., Inc., is composed of a group of men mostly of Minneapolis, of which the executive heads are as follows: President and general manager, L. W. Holt, and secretary and chief engineer, H. K. Greenman. While for the last two years the Automatic Light Co., Inc., has conducted an extensive sales effort in foreign fields and the foreign trade has absorbed practically its entire production, it is now prepared with greatly increased facilities for larger production to extend the sales organization to motor car distributers and their associate dealers.

The Motor Car Repair Shop

Practical Maintenance Hints

Oiling as a Motor Fountain of Youth

"IT will last a lifetime if you give it plenty of oil." These were the words of the superintendent of the service station for the X car, and the X car, as everybody knows, is considered America's finest.

This is not a lecture on car oiling, because as such it would be tiresome; most of the advice given on the subject is so onerous that no owner will follow it. However, the train of thought which this statement made is something that any brother motorist would be interested in.

He was asked how long he thought that this make of car would last before it would require an overhauling. This question came up naturally in discussing an old model which was the super's own car.

The answer that it would last a lifetime was quite unexpected. It emphasized the necessity for careful, conscientious oiling. He went on to say that most of these fine cars, cared for by the best chauffeurs in the country, had their days of luxurious usefulness shortened by improper oiling. He did not mention hard driving, inattention to adjustments or a host of other items that are often given as excuses for short life but limited himself solely to lack of lubrication. And from the way he said it there was no doubting that was exactly what he meant.

If the best cars in the country cared for by the most experienced chauffeurs are not properly oiled, how much more must the less expensive cars cared for by all types of drivers suffer in this respect?

Improper Oiling

What did he mean by improper oiling? Running the engine with insufficient oil, not changing the oil and washing the crankcase frequently enough. The same criticism applies to other chassis units.

His statement brings forcibly to mind the experience of the developer of the Fergus car, built by Mr. Ferguson, Belfast, Ireland. His car was the sensation of the New York show two or three years ago in that the whole car except the steering gear was oiled from the reservoir in the engine base. Front and rear axles and spring joints were supplied with lubricant from the engine.

How this was accomplished will be taken up later, but first it should be explained that the car was designed so that it would be almost impossible for the owner to neglect its proper lubrication. He merely had to put oil in the engine often enough to keep the level up and pack the steering gear with grease once a year.

This unusual design was the result of ten years' experience operating a large repairshop. A careful record of each repair was kept and the cause of each trouble estimated. An analysis of these was made from time to time, with the inevitable conclusion that the root of most trouble that cars fall heir to can be traced to lack of lubrication. As the evidence continued to pile up he determined to build a car which would eliminate, as far as possible, lubrication troubles, and the Fergus car was the result.

Although it has no direct bearing on the subject under discussion, it is merely satisfying natural curiosity to add that it will probably be manufactured after the war.

The oil is forced from the engine through the clutch and gearbox, lubricating all the wearing surfaces in both. From thence, part of it runs through oil-tight torque tube to the rear axle. Cantilever springs are used all around. They are lubricated from tubes running from the gearbox, oil being carried to the spring extremities and the front axle bearings through channels stepped down through the spring leaves. This system also lubricates the springs' surfaces. Collection of dust and dirt are prevented by encasing the springs in leather.

The development of this car as a result of observation of oiling troubles, coupled with the statement that America's finest car will last a lifetime, is worth taking seriously. These two illustrations show very strikingly the importance of adequate car lubrication.

To Save Time

Labor and time-saving devices and methods are profit makers for the man operating any sort of shop, and in the automotive business it means even more, because every moment a car is laid up it is costing its owner money. When he can be saved money by having prompt service, thereby giving him the use of the car, he will prove not only a lasting customer but a booster that will far outweigh any ordinary form of advertising.

It is well known that a storage battery is a thing of mystery to the average owner, and even to the experienced battery man it seems to take on contrary notions that cannot be explained except by the taking-down process to determine just what is at fault.

This taking-down process is not a difficult job under modern methods, but with

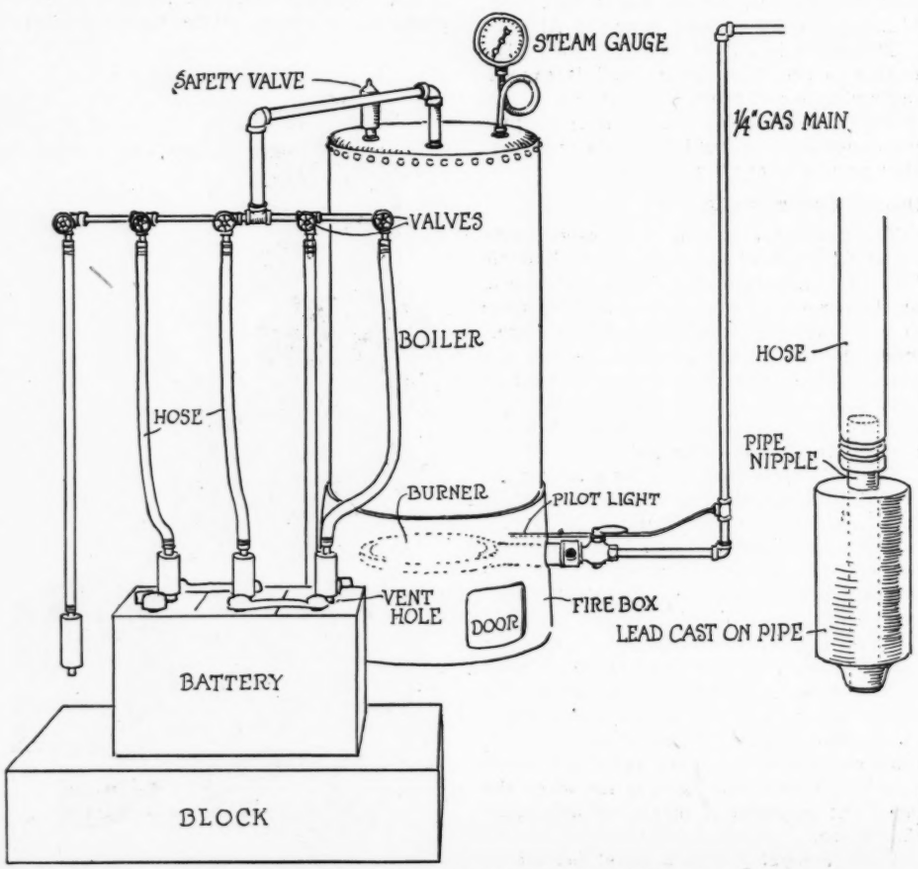


Fig. 1—Home-made apparatus for using steam to soften binder on battery

the old scheme of chopping away the binder it is no easy task, requiring time and bringing danger of knocking to pieces more than one of the delicate parts which form the accumulator.

Besides, this way requires time and the customer usually does not have sufficient of this commodity to waste hanging about a charging station until the battery can be taken down so he can make an examination of the plates and see for himself what will be needed to make the battery serviceable.

At the Willard service station on Thirty-third street in Chicago Manager Shepherd has worked out an idea that has saved that place many a dollar and also retained the good will of customers, who have had the opportunity of seeing for themselves just in what condition their batteries are.

It used to be the practice of chopping out the tar, but now steam is used to soften this binder, and it works perfectly, besides saving valuable time which may be put to other work.

The entire apparatus is home-made and consists of a small shell boiler, steam gage, safety valve, gas burner, rubber hose leading downward and a block upon which the batteries are placed, as shown in Fig. 1.

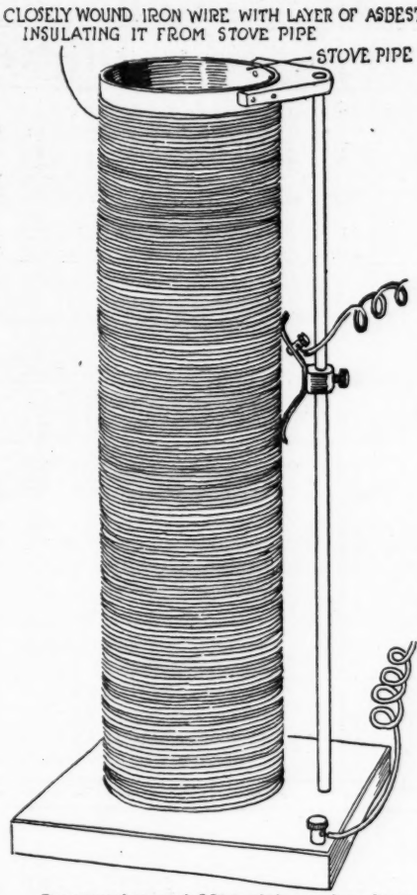
How to Make It

The boiler is 2 ft. high and 13 in. in diameter and is arranged on a suitable shelf above a firebox consisting of a piece of iron bent around the bottom part of the boiler and having in it a handhole or door to admit air and to light the burner. Into the firebox is run a gas pipe to the burner, and there is also a small pilot lead from the main gas pipe so that the water is at all times kept warm. It requires only a moment to turn on the main gas valve and have steam.

In this particular case the boiler is in on a shelf near the principal work bench, and directly in front and on the floor rests a huge wooden block upon which the batteries are placed.

Out of the top of the boiler is a pipe leading to a cross pipe having therein five Ts to provide leads downward; as many shut-off valves to control the steam, each having a lead of perhaps 2 ft. of hose. All this pipe fitting is ¼ in., which is inexpensive.

It became necessary to devise some means of holding the ends of the hose down when inserted into the vent holes of the battery, for a matter of 5 lb. of steam would permit the hose to work out. So a lead weight perhaps 3 in. long and with a diameter of 1½ in., was cast around a piece of ¼-in. pipe, which was permitted to extend 1 in. above and below ½ in. The end of the hose is attached to the top extension, while the lower extension acts as a guide to hold the lead weight in its place.



Inexpensive variable resistance for charging batteries

The battery is placed on the block and as many leads of hose are used as there are vent holes, or cells, in the battery. The end under the lead weight is placed in the vent hole and the steam turned on and left to do the work of unsealing the battery. Of course the solution must be removed first.

Starting with 5 lb. of steam, this is brought down quickly so the gage will show nothing, but there is sufficient to do the work. Usually 5 min. will be required to loosen the sealing, but a little more time will do no injury. Then each cell easily may be pulled out, drained for a few moments, and the work of inspection can take place. The owner need not be delayed beyond 10 min. to see the exact condition of his battery and to know what will be required to put it into shape for continued use.

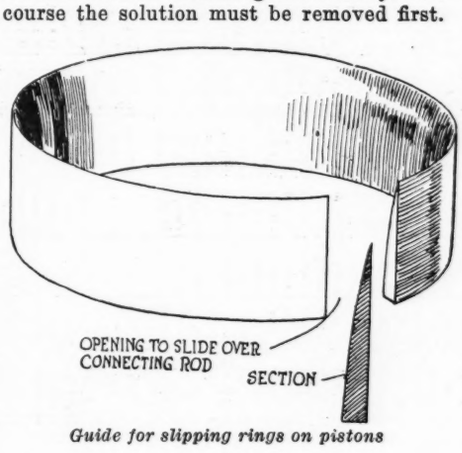
The small-size hot water boilers can be used for the purpose, and any capable mechanic can fit up the pipe work, using ¼-in. pipe and fittings all through.

Variable Resistance

A cheap and easily constructed variable resistance for battery charging or other work can be made with a stove pipe as the basis. It is mounted on a wooden pedestal and covered on the outside with a sheet of asbestos. Then it is wound evenly with iron wire throughout its whole length. It is not desirable to have adjacent coils touching and, therefore, pains should be taken to keep them apart just slightly while doing the winding. A wooden or other insulated rod serves as a guide for a sliding contact which may be placed in any desired position depending on the amount of resistance wanted. One wire is connected to this contact and the other connects to the base of the coil, so that all the wire between the base of the coil and the sliding contact, whatever its position, is acting as resistance.

Piston Ring Guide

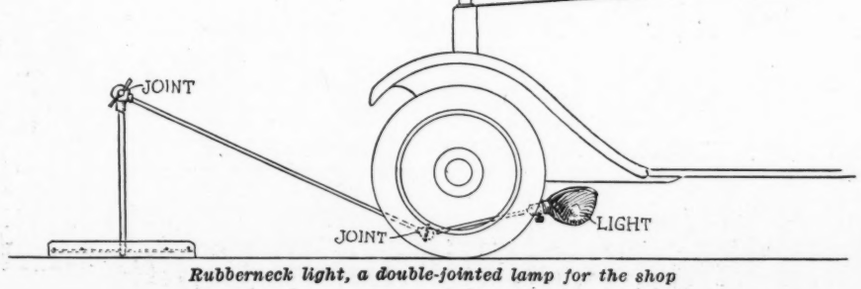
When difficulty is experienced in slipping a piston into its cylinder due to the rings catching, a simple way to overcome the trouble is to make a steel ring which is just the diameter of the cylinder bore at one end and is tapered off at the other so that it is large enough to just slip over the piston ring. The design shown here has a notch about 1 in. wide cut in it so that it may be disengaged by slipping it past the connecting rod in case this is necessary, as it is found that in some cases a solid ring cannot be removed after the piston is in place. It will be noted that such a ring may be used either for introducing pistons from the crankcase end or from the top of the cylinder, after the head is removed.



Guide for slipping rings on pistons

Rubberneck Light

There are times when the ordinary shop trouble lamp is not just what is wanted, because to throw the light exactly where it is required calls for a man to hold it. To save this man's time it is possible to construct a double-jointed lamp stand mounted on a good firm base, such as a reinforced concrete base a foot square and 2 in. thick. The joints should be of a type which permits them being locked in any position. With this light it should be possible to reach almost any point in, around or underneath the car.



Rubberneck light, a double-jointed lamp for the shop

Motor Age Monthly Guide to Truck Specifications

Name and Model	Tons Capacity	Chassis Price	Front Tires	Rear Tires	Name of Engine	No. Cyl., Bore and Stroke	Ignition	Electric Lighting	Governor	Carbureter	Clutch	Gearset	Final Drive	Axle	Steering Gear
A. & B., 3T.	3	.....	48x3½d	48x3½d	Own	4-5 17x4½	Bosch	none	none	Scheb.	none	Own	in-g.	Own	Gem.
A. & B., 5T	5	.....	48x3½d	48x5d	Own	4-5 17x4½	Bosch	none	none	Scheb.	B.&B.	Own	in-g.	Own	Gem.
Acason, B	1½	.....	36x3½	36x5	Wauk.	4-3½x5½	Eise.	Nlite.	Wauk.	Scheb.	Muncie	Cover	worm	Timkn.	Ross
Acason, H	2	.....	36x4	36x7	Buda	4-4½x5½	Eise.	Nlite.	none	Scheb.	Muncie	Muncie	worm	Timkn.	Ross
Acason, L	3½	.....	36x5	36x5d	Wauk.	4-4½x6½	Eise.	Nlite.	Wauk.	Scheb.	Muncie	Muncie	worm	Timkn.	Ross
Acason, M	5	.....	36x6	40x6d	Wauk.	4-4½x6½	Eise.	none	Wauk.	Scheb.	Fuller	Fuller	worm	Timkn.	Ross
Acason, R	1	.....	24x3½	34x5	Buda	4-3½x5½	Eise.	.....	Mon.	Scheb.	Muncie	Muncie	worm	Timkn.	Ross
Acason, Tractor	6	.....	36x4	36x7	Wauk.	4-4½x5½	Eise.	.....	Wauk.	Scheb.	B.&B.	Cotta	worm	Timkn.	Ross
Acason, Tractor	10	.....	36x5	36x5d	Wauk.	4-4½x6½	Eise.	G&D	Duplx.	Ray.*	B.&B.	Cotta	worm	Timkn.	Ross
Acme, B	1	$1,950	34x3½	34x5	Cont.	4-3½x5	Eise.	.....	Duplx.	Ray.*	B.&B.	Cotta	worm	Timkn.	Ross
Acme, A	2	2,750	36x4	36x7	Cont.	4-4½x5½	Eise.	none	Duplx.	Ray.*	B.&B.	Cotta	worm	Timkn.	Ross
Acme, C	3½	3,650	36x5	40x5d	Cont.	4-4½x5½	Eise.	none	Cont.	Ray.*	B.&B.	Hoosier	B-Lipe	Russel	Lavn.
Acme, E	5	.....	36x6	40x6d	Cont.	4-4½x6	Eise.	Bijur*	Duplx.	Strom.	B.&B.	G-Lees	in-g.	Torbn.	Ross
Air-O-Flex, 188	2	.....	36x4	36x7	H-S	4-4½x5½	A-K	none	none	Strom.	B.&B.	B-Lipe	worm	Timkn.	Ross.
All American, AA	1	1,295	33x4*	32x4	Buda	4-3½x5	Dixie	none	Pierce	Sc'eb.	B-Lipe	B-Lipe	worm	Timkn.	Ross.
American	2	.....	36x4	36x7	Buda	4-4½x5½	Eise.	West.	Pierce	Scheb.	B-Lipe	B-Lipe	worm	Timkn.	Ross.
American	3½	.....	36x5	36x5d	Buda	4-4½x5½	Eise.	West.	Pierce	Scheb.	B-Lipe	B-Lipe	worm	Timkn.	Ross
American	5	.....	36x6	40x6d	Buda	4-4½x6	Eise.	none	Pierce	Scheb.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Armleder, HW	2	.....	36x4	36x4d	Cont.	4-4½x5½	Eise.	none	Pierce	Scheb.	B-Lipe	Own	d-rd.	Hess	Lavn.
Armleder, KW	3½	.....	36x5	36x5d	Cont.	4-4½x5½	Remy	Remy*	none	Carter	B-&B.	B-Lipe	worm	Timkn.	Gem.
Atlas, 19	¾	1,135	32x4*	32x4*	Lyc.	4-3½x5	Eise.	none	Pierce	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Atterbury, 7R	1½	2,575	36x3½	36x5	Cont.	4-4½x5½	Eise.	none	Pierce	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Atterbury, 7C	2	2,975	36x4	36x4d	Cont.	4-4½x5½	Eise.	none	Pierce	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Atterbury, 7D	3½	3,875	36x5	40x5d	Cont.	4-4½x6	Eise.	Delco	Cont.	Zenith*	B-Lipe	Own	d-rd.	Own	Own
Atterbury, 8E	5	4,975	36x5	40x6d	Cont.	2-4½x4½	Bosch	none	none	Strom.	Own	Det.	in-g.	Own	Own
Autocar, XXI-F	2	2,050	34x4	34x5	Own	4-3½x5	Koko.	none	opt.	Strom.	B.&B.	B-Lipe	worm	Timkn.	Ross
Autohorse, 10	5	2,100	34x10	.....	Cont.	4-3½x5	Bosch	.....	.....	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Available, 1	1	2,250	36x3½	36x5	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Available, 2	2	2,950	36x4	36x6	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Available, 3	3½	4,200	36x5	40x5d	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Available, 5	5	4,900	36x6	40x6d	Cont.	4-4½x5½	Bosch	.....	.....	Strom.	Fuller	Fuller	in-g.	Clark	Lavn.
Beck, A	1	1,350	34x3	34x4	Cont.	4-3½x5	.....	.....	.....	Strom.	Fuller	Fuller	in-g.	Clark	Lavn.
Beck, B	1½	1,750	34x3½	34x5	Cont.	4-3½x5	Bosch	.....	.....	King*	Fuller	Fuller	in-g.	Clark	Lavn.
Beck, C	2	2,150	36x3½	36x6	Cont.	4-	Bosch	.....	.....	King*	Fuller	Fuller	in-g.	Clark	Lavn.
Beech Creek, 3A	3	3,850	36x6	36x6	Wauk.	4-4½x5½	Eise.	.....	Wauk.	Zenith	B.&B.	Own	bevel	Own	Own
Bessemer, G	1	1,450	34x3½	34x4	Cont.	4-3½x5	Split.	none	none	Zenith	B.&B.	Fuller	in-g.	Torbn.	Ross
Bessemer, H	1½	1,945	36x3½	36x5	Cont.	4-3½x5	Split.	opt.	none	Zenith	B.&B.	B-Lipe	in-g.	Torbn.	Ross
Bessemer, J	2	2,490	36x4	36x4d	Cont.	4-4½x5½	Split.	opt.	Pierce	Ray.	B.&B.	B-Lipe	in-g.	Torbn.	Ross
Bessemer, K	3½	3,450	36x5	36x5d	Cont.	4-4½x5½	Split.	opt.	Pierce	Ray.	B.&B.	B-Lipe	in-g.	Torbn.	Ross
Bethlehem, D	1½	1,965	34x3½	34x5	N.A.	4-3½x4½	A-K	G&D*	Mon.	Scheb.	B.&B.	Det.	in-g.	Torbn.	Lavn.
Bethlehem, E	2½	2,365	34x4	34x6	N.A.	4-4 x4½	A-K	G&D*	Mon.	Scheb.	B.&B.	Det.	in-g.	Torbn.	Lavn.
Bethlehem, F	3½	3,465	34x4	34x5d	N.A.	4-4½x6	A-K	G&D*	Mon.	Mon.	B.&B.	Det.	in-g.	Torbn.	Lavn.
Bourne, VM	2	3,500	36x4	36x8	Herc.	4-4 x5½	Eise.	Entz*	Simplx.	Zenith	Entz	Entz	worm	Timkn.	Ross
Bourne, XM	3½	4,200	36x5	36x10	Herc.	4-4½x5½	Eise.	Entz*	Simplx.	Zenith	Entz	Entz	worm	Timkn.	Ross
Brinton, H	1	1,500	33x4½*	33x4½*	Wis.	4-3½x5	.....	.....	none	.....	.....	.....	worm	Timkn.	Ross
Brinton, F	2½	3,000	36x4	36x6	Cont.	4-4½x5½	Bosch	.....	Pierce	.....	.....	.....	worm	Timkn.	Ross
Briscoe, 4-24	½	885	31x4*	31x4*	Own	4-3⅞x5½	Conn.	A-L*	none	Buick	Own	Own	bevel	Own	Own
Briscoe, T-34	1	.....	33x4*	34x4	Own	4-3½x5	Conn.	A-L*	Own	Buick	Own	Own	in-g.	Russel	Lavn.
Brockway, J2	1½	2,450	36x3½	36x5	Cont.	4-4½x5½	Eise.	none	none	Scheb.	Hart	B-Lipe	worm	Timkn.	Gem.
Brockway, K3	2	2,850	36x4	36x7	Cont.	4-4½x5½	Eise.	none	none	Scheb.	Hart	B-Lipe	worm	Timkn.	Gem.
Brockway, R	3½	3,750	36x5	36x5d	Cont.	4-4½x5½	Eise.	none	none	Scheb.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Chase, A	1	1,725	36x3½	36x5	Wauk.	4-3½x5½	Bosch	.....	Mon.	Strom.	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Chase, C	1½	2,025	36x3½	36x6	Wauk.	4-3½x5½	Bosch	.....	Mon.	Strom.	B.&B.	Cotta	worm	Shel.	Lavn.
Chase, B	2½	2,475	36x4	36x4d	Buda	4-4½x5½	Bosch	.....	Mon.	Strom.	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Chase, X	3	2,800	36x4	36x5d	Buda	4-4½x5½	Bosch	.....	Mon.	Strom.	B-Lipe	B-Lipe	worm	Salsby.	Lavn.
Chase, O	3½	3,000	36x5	36x5d	Cont.	4-4½x5½	Bosch	Dneto.*	Mon.	Strom.	B-Lipe	Warner	worm	Shel.	Lavn.
Chevrolet, T	1	.....	31x4*	32x4	Own	4-3½x5½	Remy	A-L*	Mon.	Zenith	Own	B-Lipe	worm	Ind.	Warn.
Clydesdale, 45	1½	.....	36x3½	36x5	Cont.	4-4½x5½	Lau.	.....	Own	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Clydesdale, 65	2	.....	3bx4	36x4d	Cont.	4-4½x5½	Bosch	.....	Own	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Clydesdale, 90	3½	.....	36x5	40x5d	Cont.	4-4½x5½	Bosch	.....	Own	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross

Name and Model	Tons Capacity	Chassis Price	Front Tires	Rear Tires	Name of Engine	No. Cyl., Bore and Stroke	Ignition	Electric Lighting	Governor	Carbureter	Clutch	Gearset	Final Drive	Axle	Steering Gear
Gabriel, F	4	4,300	36x5	40x6d	Buda	4-4½x6	Bosch	L-N*	Duplx.	Ray.	B.&B.	B-Lipe	worm	Timkn.	Gem.
Garford, 75-C	1	2,500	34x4½*	36x4	Buda	4-3½x5½	Split.	West.	Duplx.	Ray.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Garford, 66-B	1½	3,000	36x3½	36x5	Buda	4-3½x5½	Split.	West.	Duplx.	Ray.	B-Lipe	Own	worm	Timkn.	Ross
Garford, 70-B	2	3,300	36x4	36x7	Buda	4-4½x5½	Split.	West.	Duplx.	Ray.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Garford, 77B	3½	4,300	36x5	40x5d	Wis.	4-4½x6	Eise.	West.	Duplx.	Ray.	B-Lipe	Own	chain	Own	Ross
Garford, 68	5	5,000	36x6	40x6d	Wis.	4-5 16x5½	Eise.	West.	Duplx.	Ray.	B-Lipe	Own	worm	Timkn.	Ross
Garford, 69	6	5,300	36x6	40x7d	Wis.	4-4½x5½	Split.	West.	Duplx.	Ray.	B-Lipe	Own	worm	Timkn.	Ross
Garford Trac, 70-B	4½	3,400	36x4	36x7	Buda	4-4½x5½	Eise.	West.	Duplx.	Ray.	B-Lipe	B-Lipe	chain	Own	Ross
Garford Trac., 77	7	4,400	36x5	40x5d	Wis.	4-5 16x5½	Eise.	West.	Duplx.	Ray.	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Gar. Trac., 68	10	5,100	36x6	40x6d	Wis.	4-5 16x5½	Eise.	Vesta	Pierce	Strom.	Fuller	Fuller	worm	Shel.	Lavn.
Gary, F	1	.....	36x3½	36x4	Cont.	4-3½x5	Eise.	Vesta	Pierce	Strom.	Fuller	Fuller	worm	Shel.	Lavn.
Gary, G	1½	.....	36x3½	36x5	Buda	4-4½x5½	Eise.	Vesta	Simplx	Strom.	Fuller	Fuller	worm	Shel.	Lavn.
Gary, H	2	.....	36x4	36x6	Buda	4-4½x5½	Eise.	Vesta	Simplx	Strom.	Fuller	Fuller	worm	Shel.	Lavn.
Gary, HU	2½	.....	36x4	36x7	Buda	4-4½x6	Eise.	Vesta	Duplx.	Strom.	Warner	Warner	bevel	W-W.	Fost.
Gary, K	3½	.....	36x5	36x5d	Buda	4-4½x6	Eise.	Dneto.*	.....	Car.	B.&B.	G-Lees	.....	Shel.	.....
Gem	¾	675	31x4*	31x4*	G.B.S	4-3½x4½	Conn.	.....	.....	Scheb.	Warner	Warner	chain	Timkn.	Jacx.
Geneva, 1	1	1,850	34x3½	34x5	Beav.	2-5½x4½	Simms	.....	.....	Scheb.	Warner	Warner	worm	Timkn.	Jacx.
Giant, 15	1½	2,400	34x3½	34x5	Cont.	4-3½x5	Eise.	Det.	.....	Scheb.	Warner	Warner	worm	Timkn.	Jacx.
Giant, 14	2	2,850	36x4*	36x7*	Cont.	4-3½x5	Eise.	Det.	.....	Scheb.	Warner	Warner	worm	Timkn.	Ross
Giant, 16	3½	3,850	36x5	36x5d	Cont.	4-4½x5½	Eise.	Det.	.....	Strom.	Warner	Warner	worm	Clark	Lavn.
Giant, 17	1	1,490	34x3½	34x4	Cont.	4-4½x5½	Eise.	Det.	Pierce	Mast.	B.&B.	Cover	in-g.	Shel.	Lavn.
Globe, A	1½	1,850	36x3½	36x5	Cont.	4-3½x5	Eise.	.....	Pierce	Mast.	B.&B.	B-Lipe	in-g.	Clark	Lavn.
Globe, B	2	2,190	36x4	36x6	Cont.	4-3½x5½	Eise.	.....	Pierce	Mast.	B.&B.	Cover	in-g.	Clark	Lavn.
Globe, C	¾	1,775	35x5*	35x5*	Cont.	4-4½x5½	Eise.	.....	Mon.	Own	Own	Own	bevel	Own	Own
G. M. C., 16	1	2,125	34x3½	34x5	Cont.	4-3½x5	Eise.	.....	Mon.	Marvel	Own	Own	worm	Timkn.	Lavn.
G. M. C., 21	1½	2,500	36x3½	36x5	Cont.	4-3½x5	Fise.	.....	Mon.	Marvel	Own	Own	worm	Timkn.	Lavn.
G. M. C., 31	2	2,800	3bx4	36x4d	Cont.	4-3½x5	Eise.	.....	Mon.	Marvel	Own	Own	worm	Timkn.	Lavn.
G. M. C., 41	3½	3,950	36x5	40x5d	Cont.	4-4½x5½	Eise.	.....	Mon.	Marvel	Own	Own	worm	Timkn.	Lavn.
G. M. C., 71	5	4,550	36x6	40x6d	Cont.	4-4½x5½	Eise.	.....	Wauk.	Zenith	Own	Own	worm	Shel.	Ross
G. M. C., 101	1½	2,450	34x3½	36x5	Wauk.	4-3½x5½	Fise.	.....	Wauk.	Zenith	Own	Own	worm	Shel.	Ross
Gramm-B., W	2	2,750	34x4	34x3½d	Wauk.	4-4½x5½	Eise.	.....	Wauk.	Zenith	Own	Own	worm	Shel.	Ross
Gramm-B., W	2½	3,350	36x4	36x4d	Wauk.	4-4½x5½	Eise.	.....	Wauk.	Zenith	Own	Own	worm	Shel.	Ross
Gramm-B., W	3½	4,000	36x5	40x5d	Wauk.	4-4½x6½	Eise.	.....	Wauk.	Zenith	Own	Own	worm	Shel.	Ross
Gramm-B., W	5	5,000	36x6	40x6d	Wauk.	4-3½x5	Dixie	Bijur*	none	Car.*	B.&B.	G-Lees	in-g.	Torbn.	Ditw.
Gramm-B., W	¾	1,125	32x4*	32x4*	H-S.	4-3½x5	Dixie	Remy*	Pierce	Car.*	B.&B.	G-Lees	in-g.	Torbn.	Jacx.
Grant, 12	1½	1,885	34x4½*	34x5	Cont.	4-3½x5	Dixie	Remy*	Pierce	Car.*	B.&B.	G-Lees	in-g.	Torbn.	Jacx.
Grant, 10	1½	1,935	34x4½*	34x5	Cont.	4-3½x5	Dixie	Remy*	Pierce	Car.*	B.&B.	G-Lees	in-g.	Torbn.	Jacx.
Grant, 11	2	2,150	34x4	34x6	Cont.	4-3½x5	Dixie	Remy*	Pierce	Car.*	B.&B.	G-Lees	in-g.	Torbn.	Jacx.
Grant, 15	2	2,250	34x4	34x6	Cont.	4-3½x5	Eise.	.....	.....	Strom.	Det.	Det.	in-g.	Torbn.	Lavn.
Grant, 16	1	1,375	34x3	34x4	Cont.	4-3½x5	Bosch	.....	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Hahn, G	1½	1,950	36x3½	36x5	Cont.	4-4½x5½	Bosch	.....	Duplx.	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Hahn, C	2½	2,500	36x4	36x4d	Cont.	4-4½x5½	Bosch	.....	Duplx.	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Hahn, E	2	2,675	36x4	36x4d	Cont.	4-4½x5½	Bosch	.....	Duplx.	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Hall	3½	3,500	36x5	36x5d	Cont.	4-4½x5½	Bosch	.....	Duplx.	Zenith	B-Lipe	B-Lipe	chain	Timkn.	Gem.
Hall	5	4,500	36x5	40x6d	Cont.	4-4½x5½	Bosch	.....	Duplx.	Zenith	B-Lipe	B-Lipe	worm	Shel.	Ross
Hall	7	4,500	36x5	40x6d	Cont.	4-4½x5½	Eise.	.....	Duplx.	Strom.	B.&B.	B-Lipe	worm	Shel.	Ross
Hall	¾	3,000	36x4	36x7	Buda	4-4½x6	Eise.	.....	Duplx.	Strom.	B.&B.	B-Lipe	worm	Shel.	Ross
Harvey, WFA	2½	3,900	36x5	36x5d	Buda	4-4½x6	Eise.	West.*	Duplx.	Strom.	B.&B.	B-Lipe	worm	Shel.	Ross
Harvey, WHA	3½	5,000	36x6	40x6d	Buda	4-4½x6	Eise.	Vesta	Simplx	Strom.	B.&B.	B-Lipe	worm	Shel.	Ross
Harvey, WKA	5	4,000	36x5	36x5d	Buda	4-4½x6	Eise.	Vesta	Simplx	Zenith	Fuller	Fuller	in-g.	Clark	Gem.
Harvey Trac., HT	10	1,900	34x3½	34x5	Buda	4-3½x5½	Dixie	.....	Simplx	Zenith	Fuller	Fuller	in-g.	Clark	Gem.
Hawkeye, K	1½	2,500	34x4	34x6	Buda	4-3½x5½	Simms	L-N.*	Wauk.	Strom.	Fuller	Fuller	worm	Timkn.	Ross
Hawkeye, L	2	2,850	36x4	36x4d	Wauk.	4-4½x5½	Simms	L-N.*	Wauk.	Strom.	B.&B.	Fuller	worm	Timkn.	Ross
Hendrickson	2	3,600	36x5	36x5d	Cont.	4-4½x5½	Simms	L-N.*	Simplx	Zenith	Cotta.	Fuller	worm	Shel.	Lavn.
Hendrickson	¾	1,850	35x5*	35x5*	Cont.	4-3½x5	Spit.	none	.....	Zenith	Fuller	Fuller	worm	Shel.	Lavn.
Higrade, A17	1	2,100	35x5*	35x5*	Cont.	4-3½x5	A-K.	West.	.....	Scheb.	Fuller	Own	s-bev.	Own	Jacx.
Higrade, A18	1	1,435	32x4*	33x4½*	Own	4-3½x5½	Eise.	Vesta	Duplx.	Strom.	Own	B-Lipe	worm	Own	.....
Hoover, 15-B	½	1,350	33x4*	33x4*	Own	4-3½x5½	Eise.	Vesta	Duplx.	Flech.	B-Lipe	B-Lipe	worm	Own	.....
Hupmobile	2	3,500	36x4	36x4d	Buda	4-4½x5½	Eise.	Vesta	Duplx.	Flech.	B-Lipe	B-Lipe	worm	Own	.....
Hurlburt	3½	4,250	36x5	36x5d	Buda	4-4½x6									
Hurlburt															

Abbreviations: **Engine**—Wauk., Waukesha; Cont., Continental; H-S, Herschell-Spillman; Lyc., Lycoming; N.A., North American; Herc., Hercules; Mil., Milwaukee; Wis., Wisconsin; LeR., LeRoi; GBS, Golden, Belknap & Swartz; Beav., Beaver. **Ignition**—Eise., Eisemann A-K, Atwater Kent; Koko., Kokomo; Split., Splitdorf; Conn., Connecticut; Lau., Lauraine; Berl., Berling; A-L, Auto-Lite. **Electric Lighting**—Nlite, Nicolite; G&D, Gray & Davis; A-L, Auto-Lite; Dneto., Dyneto; Al-Ch., Allis-Chalmers; West., Westinghouse; L-N, Leece-Neville; Det., Detroit; N-E, North East; Wag., Wagner; Asterisk, electric starting also. **Governor**—Wauk., Waukesha; Duplx., Duplex; Cont., Continental; Mon., Monarch; Simplx., Simplex; McCan., McCanna; Rugles, Ruggles. **Carbureter**—Scheb., Schebler; Strom., Stromberg; Ray., Rayfield; King., Kingston; Mon., Monarch; Shake., Shakespeare; Car., Carter; Flech., Fletcher; Holl., Holley; Ens., Ensign; Mast., Master; John., Johnson; Stew., Stewart; Till., Tillotson; Asterisk, vacuum fuel feed. **Clutch**—B.&B., Borg & Beck; B-Lipe, Brown-Lipe; Det., Detroit; H-Shaw, Hele-Shaw; Mech., Mechanics; M&E, Merchant & Evans; Lyc., Lycoming. **Gearset**—B-Lipe, Brown-Lipe; G-Lees, Grant-Lees; Det., Detroit; Mech., Mechanics; Cover., Covert; Savg., Savage Arms. **Final Drive**—in-g., internal gear; d-rd., double reduction; s-bev., spiral bevel; ext-g., external gear. **Axle**—Timkn., Timken; Torbn., Torbenson; Key-H, Keystone-Hindley; Shel., Sheldon; Salsby., Salisbury; Ind., Industrial; Chcgo., Chicago-Standard; Chgo., Chicago; W-W., Walker-Weiss; Emp., Empire, **Steering Gear**—Gem., Gemmer; Lavn., Lavine; Warn., Warner; Ditw., Ditweiler; Jacx., Jacox; Fost., Foster; Wol., Wohlrab. **Tires**—Asterisk, pneumatic.

Name and Model	Tons Capacity	Chassis Price	Front Tires	Rear Tires	Make of Engine	No. Cyl., Bore and Stroke	Ignition	Electric Lighting	Governor	Carbureter	Clutch	Gearset	Final Drive	Axle	Steering Gear
Clydesdale, 120B.	5	.....	36x5	40x6d	Cont.	4-4½x6	Bosch	.....	Own	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Collier, 16.....	1½	$1.375	33x4½*	33x4½*	Lyc.	4-3½x5	Conn.	A-L*	.....	Zenith	B.&B.	G-Lees	worm	Chcgo.	Ditw.
Columbia, E.....	2	2,350	36x4	36x6	Cont.	4-4½x5½	Split.	Vesta	Pierce	Shake.	Hart	Covert	in-g.	Russel	Own
Columbia, T.....	6	2,350	36x4	36x6	Cont.	4-4½x5½	Split.	Vesta	Pierce	Shake.	Hart	Covert	in-g.	Russel	Own
Comet.....	1	1,575	34x4	34x4	Lyc.	4-3½x5	Delco	Dneto.	.....	Carter	B.&B.	Muncie	worm	Chcgo.	CAS.
Commerce, E....	1	1,450	34x3	34x4	Cont.	4-3½x5	Split.	Bijur*	Pierce	Zenith*	Det.	Det.	in-g.	Torbn.	Jacx.
Concord, A.....	1½	2,350	36x3½	36x5	Buda	4-3½x5½	Eise.	.....	Mon.	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Concord, B.....	2½	2,850	36x4	36x4d	Buda	4-4½x5½	Eise.	.....	Mon.	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ros
Corbitt, E.....	1	2,000	34x3½	34x4	Cont.	4-3½x5	Eise.	Disco*	Pierce	Strom.	Fuller	Fuller	worm	Shel.	Lavn.
Corbitt, D.....	1½	2,400	36x3½	36x5	Cont.	4-3½x5	Eise.	Disco*	Pierce	Strom.	Fuller	Fuller	worm	Shel.	Ross
Corbitt, C.....	2	3,000	36x4	36x7	Cont.	4-4½x5½	Eise.	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
Corbitt, B.....	2½	3,200	36x4	36x7	Cont.	4-4½x5½	Eise.	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
Corbitt, A.....	3½	4,000	36x5	36x5d	Cont.	4-4½x5½	Eise.	none	Pierce	Strom.	H-Shaw	Cotta	worm	Snel.	Ross
Corbitt, AA.....	5	4,500	36x6	40x6d	Cont.	4-4½x6	Eise.	none	Pierce	Strom.	H-Snaw	Cotta	worm	Shel.	Ross
Corliss, A.....	½	800*	31x4*	31x4*	Mil.	4-3½x4½	Split.	.....	.....	Scheb.	.....	.....	bevel	.....	.....
Couple-Gear, HO.	3½	6,000	36x4d	36x4d	Cont.	4-4½x6	Eise.	.....	.....	Strom.	.....	.....	bevel	Own	Own
Couple-Gear, AO.	5	6,600	36x5d	36x5d	Wis.	4-5½x7	Eise.	.....	.....	Strom.	.....	.....	bevel	Own	Own
Croce, 17.....	½	825	32x4*	32x4	Wis.	4-3½x5	Bosch	.....	.....	Zenith	B-Lipe	B-Lipe	bevel	Timkn.	Lavn.
Dart, E.....	1	2,100	34x3½	34x5	Cont.	4-3½x5	Eise.	Bijur*	none	Zenith*	Fuller	Fuller	worm	Timkn.	Ross
Dart, CC4.....	2	2,950	36x4	36x7	Buda	4-4½x5½	Eise.	Bijur*	Pierce	Zenith	Fuller	Fuller	worm	Timkn.	Ross
Dart, L.....	3½	4,000	3ox5	36x10	Buda	4-4½x6	Eise.	Bijur*	Pierce	Zenith	Warner	Warner	worm	Timkn.	Ross
D-E, J.....	1	1,050	33x4*	LeR	4-3½x4½	Berl.	Al-Ch*	.....	.....	Scheb.	Det.	Det.	worm	Shel.	Gem.
D-E A.....	1	1,775	34x3	34x4	Cont.	4-3½x5	Berl.	.....	.....	Zenith	B.&B.	Covert	worm	Wis.	Ross
D-E, B.....	1½	2,075	34x3½	34x5	Cont.	4-3½x5	Berl.	.....	.....	Zenith	B.&B.	Covert	worm	Wis.	Ross
D-E, D.....	2	2,450	36x4	36x6	Cont.	4-4½x5½	Berl.	.....	.....	Zenith	B.&B.	Covert	worm	Wis.	Ross
D-E, C.....	2½	2,750	36x4	36x7	Buda	4-4½x5½	Berl.	.....	Mon.	Zenith	B.&B.	Covert	worm	Wis,	Ross
D-E, E.....	5	4,500	36x5	40x6d	Buda	4-4½x6	Berl.	.....	Mon.	Zenith	B-Lipe	B-Lipe	worm	Shel.	Ross
D-E, F.....	3½	3,450	36x5	36x5d	Cont.	4-4½x5½	Berl.	.....	Mon.	Zenith	B-Lipe	B-Lipe	worm	Wis.	Ross
Defiance, B.....	1½	1,795	34x3½	34x5	Cont.	4-3½x5	Eise.	Delco	Mon.	Master	Fuller	Covert	worm	Timkn.	Ross
Defiance, C.....	2	1,995	34x3½	34x5	Cont,	4½ x5	ise.	Delco	Mon.	Master	Fuller	Covert	worm	Timkn.	Ross
DeKalb, E-2.....	2	2,100	34x3½	3ox5	Cont.	4-4½x5½	Eise.	none	none	Master	Fuller	Covert	worm	Timkn.	Ross
DeKalb, E-2½....	2½	2,600	36x4	36x6	Cont.	4-4½x5½	Eise.	none	none	Strom.	B.&B.	G-Lees	in-g.	Torbn.	Ditw.
Denby, 12.....	1	1,650	34x3	34x4	Cont.	4-3½x5	Eise.	Bijur*	Mon.	Strom.	Det.	Det.	in-g.	Russel	Gem.
Denby, 13.....	2	2,350	36x3½	36x6	Cont.	4-3½x5	Eise.	Bijur*	Mon.	Strom.	Det.	Det.	in-g.	Russel	Gem.
Denby, 15.....	3	2,775	36x4	36x7	Cont.	4-3½x5	Eise.	Bijur*	Mon.	Strom.	Det.	Det.	in-g.	Russel	Gem.
Denby, 210.....	5	4,900	36x6	40x12	Cont.	4-4½x5½	Eise.	.....	Duplx.	Strom.	Own	Warner	in-g.	Clark	Ross
Diamond-T, J5...	1	2,125	36x3	36x4	Cont.	4-3½x5	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Diamond-T, J4...	1½	2,550	36x3½	36x5	Cont.	4-3½x5	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Diamond-T, J3...	2	2,925	36x4	36x7	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Diamond-T, LB...	3½	4,150	36x5	36x5d	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Diamond-T, R....	5	4,950	36x6	40x6d	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Doane, 1919.....	6	5,650	36x6	40x6d	Wauk.	4-4½x6½	Bosch	none	Wauk.	Master	B-Lipe	.....	chain	Own	Lavn.
Dorris, K4.....	2	2,985	36x4	36x7	Own	4-4½x5½	Bosch	West.*	Own	Strom.	Warner	Warner	worm	Timkn.	Ross
Douglas, TA.....	1½	2,000	34x3½	34x5	Buda	4-4½x5	Eise.	A-L	Pierce	Scheb.*	B.&B.	G-Lees	in-g.	Torbn.	Ross
Duplex, E.....	3½	4,000	36x6	36x6	Buda	4-4½x5½	Eise.	opt.	Duplx.	Scneb.*	B-Lipe	B-Lipe	in-g.	Own	Lavn.
Ellsworth, 25A...	½	855*	30x3½*	30x3½*	Lyc.	4-3½x5	.....	Dneto.*	none	Carter	Mech.	Mech.	bevel	Gemco	Fost.
Fageol.....	2	3,300	34x4	36x7	Wauk.	4-4 x5½	Dixie	.....	Wauk.	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Fargo, P.....	2	2,200	36x4	36x6	Cont.	4-3½x5	Bosch	none	Mon.	Ray.	Fuller	Fuller	in-g.	Russel	Jacx.
Federal, S.....	1	1,900	34x3	34x4	.....	4-3½x5½	Eise.	opt.	Mon.	Zenith	B.&B.	Own	worm	Timkn.	Gem.
Federal, T.....	1½	2,350	36x3½	36x5	Cont.	4-4½x5½	Eise.	opt.	Mon.	Zenith	B.&B.	Det.	worm	Timkn.	Gem.
Federal, U.....	2	2,600	36x4	36x7	Cont.	4-4½x5½	Eise.	opt.	Mon.	Zenith	B.&B.	Det.	worm	Timkn.	Gem.
Federal, W.....	3½	3,350	36x5	36x5d	Cont.	4-4½x5½	Eise.	opt.	Mon.	Zenith	B.&B.	Warner	worm	Timkn.	Gem.
Federal, X.....	5	4,400	3ox6	40x6d	Cont.	4-4½x5½	Eise.	opt.	Mon.	Zenith	B.&B.	Warner	worm	Timkn.	Gem.
Forschler.....	¾	1,535	32x2½	32x3	LeR.	4-3½x4½	Dixie	.....	Mon.	Zenith	Det.	.....	worm	Shel.	Ross
Forschler.....	1	2,000	34x3	34x4	Cont.	4-3½x5	Bosch	.....	Mon.	Zenith	Fuller	Fuller	worm	Shel.	Ross
Forschler.....	1½	2,375	34x3½	34x5	Cont.	4-3½x5	Bosch	.....	Mon.	Zenith	Fuller	Fuller	worm	Shel.	Ross
Forschler.....	2	2,750	34x4	34x6	Contl	4-4½x5½	Bosch	.....	Pierce	Zenith	Fuller	Fuller	worm	Shel.	Ross
Ford, TT.....	1	550	30x3½*	32x3½	Own	4-3½x4	Own	.....	.....	Own	Own	Own	worm	Own	Own
F.W.D., B.....	3	4,600	36x6	36x6	Wis.	4-4½x5½	Eise.	.....	Pierce	Strom.	M&E	Cotta	bevel	Own	Ross
Fulton, FX.....	1½	1,850	34x3½	34x5	H-S	4-3⅜x5 1/16	Simms	.....	Pierce	Carter	B.&B.	Own	in-g.	Russel	Lavn.
Gabriel,* C.....	1	2,000	35x5*	35x5*	Buda	4-4½x5½	Bosch	L-N*	none	Ray.	B.&B.	B-Lipe	worm	Timkn.	Gem.
Gabriel, E.....	2	3,250	36x4	36x7	Buda	4-4½x5½	Bosch	L-N*	Duplx.	Ray.	B.&B.	B-Lipe	worm	Timkn.	Gem.

Name and Model	Tons Capacity	Chassis Price	Front Tires	Rear Tires	Make of Engine	No. Cyl., Bore and Stroke	Ignition	Electric Lighting	Governor	Carbureter	Clutch	Gearset	Final Drive	Axle	Steering Gear
Hurlburt.....	5	5,250	36x5	40x6d	Buda	4-4½x6	Eise.	Vesta	Duplx.	Flech.	B-Lipe	B-Lipe	worm	Own	.....
I. H. C., H.....	¾	1,550	36x3	36x3½	Own	4-3½x5½	Bosch	N-E.*	Own	Holl.	Own	Own	in-g.	Own	Lavn.
I. H. C., F.....	1	1,850	36x3½	36x4	Own	4-3½x5½	Bosch	N-E.*	Own	Holl.	Own	Own	in-g.	Own	Lavn.
I. H. C., K.....	1½	2,200	36x3½	36x5	Own	4-3½x5½	Bosch	N-E.*.	Own	Holl.	Own	Own	in-g.	Own	Ross
I. H. C., G.....	2	2,600	36x4	36x6	Own	4-4 x5	Split.	N-E.*	Own	Ens.*	Own	Own	in-g.	Own	Ross
Independent, F..	1	1,485	36x2	36x4	Cont.	4-3½x5	Eise.	Lesco.	Mon.	Marvel	B-Lipe	B-Lipe	worm	Chgo.	Lavn.
Independent, G..	2	2,250	36x3½	36x5	Cont.	4-4½x5½	Eise.	none	Mon.	Marvel	.....	.....	worm	.....	.....
Indiana, T.....	1	2,150	34x3½	34x4	Wauk.	4-3½x5½	Eise.	West.*	Wauk.	Strom.	.....	.....	worm	Own	.....
Indiana, Q.....	1½	2,600	36x3½	36x5	Ruten	4-4½x5½	Eise.	West.	Pierce	Strom.	B.&B.	B-Lipe	worm	Shel.	Wol.
Indiana, D.....	2	2,800	36x4	36x7	Ruten	4-4½x5½	Eise.	West.	Pierce	Strom.	B.&B.	B-Lipe	worm	Shel.	Wol.
Indiana, R.....	3½	3,450	36x5	36x5d	Ruten	4-4½x5½	Eise.	West.	Pierce	Strom.	B.&B.	B-Lipe	worm	Shel.	Wol.
Indiana, L.....	5	4,600	36x5	40x6d	Wauk.	4-4½x6½	Eise.	West.	Wauk.	Strom.	B.&B.	B-Lipe	worm	Shel.	Wol.
Jumbo, A.....	2	2,500	36x4	36x7	Buda	4-4½x5½	Eise.	none	Duplx.	Zenith	Fuller	Fuller	in-g.	Clark	Jacx.
Kearns.....	½	850	30x3½*	30x3½*	Lyc.	4-3½x5	Conn.	Dneto.*	none	Carter	Mech.	Mech.	bevel	Peru	Lavn.
Kearns.....	1½	1,800	34x3½	34x5	H-S.	4-3½x5	Berl.	none	none	.....	B.&B.	G-Lees	.....	Hayes	.....
Kelly-S., K-31...	1½	2,750	36x3½	36x6	Own	4-3½x5½	Eise.	opt.*	Own	Zenith	Own	Cover	chain	Own	Gem.
Kelly-S., K-32...	1½	2,750	36x3½	36x6	Own	4-3½x5½	Eise.	opt.*	Own	Zenith	Own	Cover	worm	Own	Gem.
Kelly-S., K-35...	2½	3,250	36x4	36x4d	Own	4-3½x5½	Eise.	opt.*	Own	Zenith	Own	Cover	chain	Own	Gem.
Kelly-S., K-36...	2½	3,250	36x4	36x4d	Own	4-3½x5½	Eise.	opt.*	Own	Zenith	Own	Cover	worm	Own	Gem.
Kelly-S., K-40...	3½	4,250	36x5	40x5d	Own	4-4½x6½	Eise.	opt.*	Own	Ray.	Own	Cover	chain	Own	Gem.
Kelly-S., K-45...	4	4,400	36x5	40x6d	Own	4-4½x6½	Eise.	opt.*	Own	Ray.	Own	Cover	chain	Own	Gem.
Kelly-S' K-50...	5	4,900	36x6	40x6d	Own	4-4½x6½	Eise.	opt.*	Own	Ray.	Own	Cover	chain	Own	Gem.
Kelly-S., K-60...	6	5,200	36x6	40x7d	Own	4-4½x6½	Eise.	opt.*	Own	Ray.	Own	Cover	chain	Own	Gem.
Kimball, 2A.....	1½	.....	36x3½	36x5	Wis.	4-4 x5	Eise.	.....	Simplx.	Mast.*	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Kimball, 4A.....	2	.....	36x4	36x6	Wis.	4-4 x6	Eise.	.....	Simplx.	Mast.*	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Kimball, 6A.....	2½	.....	36x4	36x7	Wis.	4-4½x6	Eise.	.....	Simplx.	Mast.*	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Kimball, 8A.....	4	.....	36x5	40x5d	Wis.	4-4½x5½	Eise.	.....	Simplx.	Mast.*	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Kimball, 10A.....	5	.....	36x6	40x6d	Wis.	4-5 .1x5½	Eise.	.....	Simplx.	Mast.*	B-Lipe	B-Lipe	worm	Shel.	Lavn.
Kissel.....	1½	2,073	34x3½	34x5	Own	4-3½x5½	Eise.	●	Pierce	Strom.	Warner	Warner	worm	Shel.	Jacx.
Kissel.....	2	2,832	34x4	36x7	Own	4-4½x5½	Eise.	●	Pierce	Strom.	Warner	Warner	worm	Timkn.	Lavn.
Kissel.....	3½	3,905	36x5	36x5d	Own	4-4½x5½	Eise.	●	Pierce	Strom.	Warner	Warner	worm	Shel.	Ross
Kissel.....	5	4,785	36x6	36x6d	Own	4-4½x5½	Eise.	●	Pierce	Strom.	Warner	Warner	worm	Shel.	Ross
Kleiber, AA.....	1	2,400	34x3½	34x5	Cont.	4-3½x5½	Bosch	.....	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Kleiber, A.....	1½	2,650	36x3½	36x6	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	H-Shaw	B-Lipe	worm	Shel.	Ross
Kleiber, BB.....	2	2,950	36x4	36x3½d	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	H-Shaw	B-Lipe	worm	Timkn.	Ross
Kleiber, B.....	2½	3,500	36x4	36x4d	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	H-Shaw	B-Lipe	worm	Shel.	Ross
Kleiber, C.....	3½	4,100	36x5	36x5d	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	H-Shaw	B-Lipe	worm	Timkn.	Ross
Kleiber, D.....	5	5,100	36x6	40x6d	Cont.	4-5½x5½	Bosch	.....	Pierce	Strom.	H-Shaw	B-Lipe	worm	Timkn.	Ross
Knox, 35.....	.....	.....	36x5	38x6d	Own	4-5 x5½	Eise.	Bijur.*	none	Zenith*	Own	Own	chain	Timkn.	Ross
Knox, 36.....	.....	.....	36x4	38x6d	Own	4-5 x5½	Eise.	Bijur.*	none	Zenith*	Own	Own	chain	Timkn.	Ross
Koehler, K.....	1½	1,450	34x3	34x4	Own	4-3½x5	Eise.	none	Mon.	Strom.	.....	.....	in-g.	Torbn.	Own
Koehler, L.....	2½	1,985	34x4	34x6	Own	4-3½x5	Eise.	none	Mon.	Strom.	.....	.....	in-g.	Torbn.	Own
Koehler Trac., KT	3	1,750	34x3	34x5	Own	4-3½x5	Eise.	none	Mon.	Strom.	.....	.....	in-g.	Torbn.	Own
Koehler Trac., LT	5	2,165	34x4	34x6	Own	4-3½x5	Eise.	none	Mon.	Strom.	.....	.....	in-g.	Torbn.	Own
LaFrance, 2-A...	2	3,500	36x4	36x7	Cont.	4-4½x5½	Conn.	Dneto.*	Simplx.	Zenith	B.&B.	B-Lipe	worm	Timkn.	Ross
Lane, G.....	1½	2,250	34x3½	34x5	Cont.	4-3½x5	Eise.	.....	Pierce	Strom.	Fuller	Fuller	worm	.....	Ross
Lane, H.....	2½	2,850	34x4	36x6	Cont.	6-3½x5½	Eise.	.....	Pierce	Strom.	B.&B.	Cover	worm	Timkn.	Ross
Lane, K.....	3½	3,700	36x5	36x5d	Cont.	6-3½x5½	Eise.	.....	Pierce	Strom.	B.&B.	Cover	worm	Shel.	Ross
Lange, B.....	2	2,950	36x4	36x6	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	H-Shaw	Own	chain	Own	Gem.
Lapeer Trac., 3..	3	1,650	34x3½	34x5	Wauk.	4-3½x5½	Dixie	.....	Wauk.	Stew.	Fuller	Fuller	in-g.	Torbn.	Ross
Lapeer Trac., 5..	5	2,200	34x3½	34x3½d	Wauk.	4-3½x5½	Dixie	.....	Wauk.	Stew.	Fuller	Fuller	in-g.	Torbn.	Ross
Larrabee, M.....	1	1,950	34x3½	34x5	Cont.	4-3½x5	Bosch	.....	Pierce	Scheb.	Fuller	Fuller	worm	Shel.	Lavn.
Larrabee, C-D...	2½	3,000	36x4	36x7	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
Larrabee, A.....	2½	3,950	36x5	36x5d	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
Larrabee, T.....	5	4,750	36x5	40x6d	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
Lippard-St., C...	¾	1,900	35x4½*	35x4½*	Cont.	4-3½x5½	Eise.	Dneto.*	Pierce	Zenith	Hart	B-Lipe	s-bev.	Timkn.	Ross
Lippard-St., H...	1	2,250	36x3	36x5	Cont.	4-3½x5½	Eise.	Dneto.*	Pierce	Zenith	Hart	B-Lipe	worm	Timkn.	Ross
Lippard-St., F...	1½	2,750	36x3½	36x3d	Cont.	4-4½x5½	Eise.	Dneto.*	Pierce	Zenith	Hart	B-Lipe	worm	Timkn.	Ross
Lippard-St., G...	2	3,050	36x4	36x4d	Cont.	4-4½x5½	Eise.	Dneto.*	Pierce	Zenith	Hart	B-Lipe	worm	Timkn.	Ross
Lombard, 5.....	.....	.....	.....	.....	.....	6-5½x7	.....	.....	.....	Strom.	.....	.....	worm	.....	.....
Loyal.....	¾	835	32x4*	32x4*	H-S.	4-3½x5	A-K.	●	.....	Strom.	B.&B.	Cover	in-g.	Torbn.	.....
Loyal.....	¾	950	32x4*	32x4*	H-S.	4-3½x5	A-K.	●	.....	Strom.	B.&B.	Cover	in-g.	Torbn.	.....

Abbreviations: **Engine**—Wauk., Waukesha; Cont., Continental; H-S, Herschell-Spillman; Lyc., Lycoming; N.A., North American; Herc., Hercules; Mil., Milwaukee; Wis., Wisconsin; LeR., LeRoi; GBS, Golden, Belknap & Swartz; Beav., Beaver. **Ignition**—Eise., Eisemann; A-K, Atwater Kent; Koko., Kokomr; Split., Splitdorf; Conn., Connecticut; Lau., Lauraine; Berl., Berling; A-L, Auto-Lite. **Electric Lighting**—Nhte, Nicolite; G&D, Gray & Davis; A-L, Auto-Lite; Dneto., Dyneto; Al-Ch., Allis-Chalmers; West., Westinghouse; L-N, Leece-Neville; Det., Detroit; N-E, North East; Wag., Wagner; Asterisk, electric starting also. **Governor**—Wauk., Waukesha; Duplx., Duplex; Cont., Continental; Mon., Monarch; Simplx., Simplex; McCan., McCanna; Rugles, Ruggles. **Carbureter**—Scheb., Schebler; Strom., Stromberg; Ray., Rayfield; King., Kingston; Mon., Monarch; Shake., Shakespeare; Car., Carter; Flech., Fletcher; Holl., Holley; Ens., Ensign; Mast., Master; John., Johnson; Stew., Stewart; Till., Tillotson; Asterisk, vacuum fuel feed. **Clutch**—B.&B., Borg & Beck; B-Lipe, Brown-Lipe; Det., Detroit; H-Shaw, Hele-Shaw; Mech., Mechanics; M&E, Merchant & Evans; Lyc., Lycoming. **Gearset**—B-Lipe, Brown-Lipe; G-Lees, Grant-Lees; Det., Detroit; Mech., Mechanics; Cover., Covert; Savg., Savage Arms. **Final Drive**—in-g., internal gear; d-rd., double reduction; s-bev., spiral bevel; ext-g., external gear. **Axle**—Timkn., Timken; Torbn., Torbenson; Key-H, Keystone-Hindley; Shel., Sheldon; Salsby., Salisbury; Ind., Industrial; Chcgo., Chicago-Standard; Chgo., Chicago; W-W., Walker-Weiss; Emp., Empire. **Steering Gear**—Gem., Gemmer; Lavn., Lavine; Warn., Warner; Ditw., Ditweiler; Jacx., Jacox; Fost., Foster; Wol., Wohlrab. **Tires**—Asterisk, pneumatic.

Motor Age Monthly Truck Specifications—Concluded

Name and Model	Tons Capacity	Chassis Price	Front Tires	Rear Tires	Make of Engine	No. Cyl., Bore and Stroke	Ignition	Electric Lighting	Governor	Carbureter	Clutch	Gearset	Final Drive	Axle	Steering Gear
Maccar, L	1½	2,750	36x4	36x5	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Maccar, H	2½	3,300	36x4	36x4d	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Maccar, M	3½	4,100	36x5	36x5d	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Maccar, U	5½	5,000	36x5	40x6d	Wis.	4-5 1x5	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Mack, AB	1	2,400	36x4	36x3½d	Own	4-4 x5	Split.	opt.	Own	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Mack, AB	1	2,400	36x4	36x3½d	Own	4-4 x5	Split.	opt.	Own	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Mack, AB	1½	2,800	36x4	36x3½d	Own	4-4 x5	Split.	opt.	Own	opt.	B-Lipe	B-Lipe	chain	Own	Gem.
Mack, AB	1½	2,800	36x4	36x3½d	Own	4-4 x5	Split.	opt.	Own	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Mack, AB	2	3,000	36x4	36x4d	Own	4-4 x5	Split.	opt.	Own	Strom.	B-Lipe	B-Lipe	chain	Timkn.	Gem.
Mack, AB	2	3,000	36x4	36x4d	Own	4-4 x5	Split.	opt.	Own	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Mack, AB	2	3,000	36x4	36x4d	Own	4-4 x5	Split.	opt.	Own	Strom.	B-Lipe	B-Lipe	chain	Own	Gem.
Mack, AB	5	.....	36x4	36x4d	Own	4-4 x5	Split.	opt.	Own	Strom.	B-Lipe	B-Lipe	chain	.....	Gem.
Mack, AC	3½	4,600	36x5	40x5d	Own	4-5 x6	Split.	opt.	Own	Strom.	Own	Own	chain	Own	Gem.
Mack, AC	5½	5,250	36x6	40x6d	Own	4-5 x6	Split.	opt.	Own	Strom.	Own	Own	chain	Own	Gem.
Mack Trac., AC	7	4,600	36x5	40x5d	Own	4-5 x6	Split.	opt.	Own	Strom.	Own	Own	chain	Own	Gem.
Mack, AC	7½	5,500	36x7	40x7d	Own	4-5 x6	Split.	opt.	Own	Strom.	Own	Own	chain	Own	Gem.
Mack Trac., AC	11	5,250	36x6	40x6d	Own	4-5 x6	Split.	opt.	Own	Strom.	Own	Own	chain	Own	Gem.
Mack Trac., AC	15	5,500	36x7	40x7d	Own	4-5 x6	Split.	opt.	Own	Strom.	Own	Own	chain	Own	Gem.
Manly, 30	1½	2,050	36x4	36x5	Wauk.	4-3½x5½	Eise.	.....	Wauk.	Zenith*	.....	.....	worm	.....	.....
Manly, 40	2	2,350	36x4	36x6	Wauk.	4-3½x5½	Eise.	.....	Wauk.	Zenith*	.....	.....	worm	.....	.....
Manly, 50	2½	2,800	36x4	40x7	Wauk.	4-4 x5½	Eise.	.....	Wauk.	Zenith*	.....	.....	worm	.....	.....
Master, M	2	2,390	34x4	36x4	Buda	4-4½x5½	Eise.	West.	McCan.	Mast.	Fuller	Fuller	in-g.	Torbn.	Wol.
Master, O	2	2,490	34x4	36x4	Buda	4-4½x5½	Eise.	opt.	McCan.	Mast.	Fuller	Fuller	in-g.	Torbn.	Wol.
Master, W	2	2,590	34x4	36x4	Buda	4-4½x5½	Eise.	West.*	McCan.	Mast.	Fuller	Fuller	worm	Timkn.	Wol.
Master, WL	2	2,690	34x4	36x4	Buda	4-4½x5½	Eise.	West.*	McCan.	Mast.	Fuller	Fuller	worm	Timkn.	Wol.
Master, A	3½	3,890	36x5	40x5d	Buda	4-4½x6	Eise.	West.	Pierce	Mast.	B-Lipe	B-Lipe	worm	Timkn.	Wol.
Maxfer	1	1,195	36x4*	34x4	.....	4-3½x5	Delco	Delco*	.....	.....	.....	.....	worm	.....	.....
Maxwell	1	1,025	32x3	32x4	Own	4-3½x4½	A-K.	A-L.	Own	John.	Own	Own	worm	Own	Own
Menominee	1	1,890	34x3½	34x5	Cont.	4-3½x5	Eise.	.....	Pierce	Strom.	Fuller	Fuller	worm	Timkn.	Gem.
Menominee, H	1½	2,475	36x3½	36x5	Cont.	4-3½x5½	Eise.	.....	Pierce	.....	Fuller	Fuller	worm	Timkn.	Gem.
Menominee, D	2	2,950	36x4	36x4d	Cont.	4-4½x5½	Eise.	.....	Pierce	.....	Fuller	Fuller	worm	Timkn.	Gem.
Menominee, G	3½	3,880	36x5	36x5d	Cont.	4-4½x5½	Eise.	.....	Pierce	Strom.	Fuller	Fuller	worm	Timkn.	Gem.
Menominee, J	5	4,950	36x6	40x6d	Cont.	4-4½x5½	Eise.	.....	Pierce	.....	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Modern, 30	...	1,800	34x3½	34x5	Cont.	4-3½x5	.....	.....	opt.	Zenith	Fuller	Fuller	worm	Timkn.	Ross.
Moreland, 17-N	1	2,175	34x3½	34x4	Cont.	4-3½x5	Dixie	.....	.....	Miller	Own	Own	worm	Timkn.	Ross.
Moreland, 17-B	1½	2,930	36x3½	36x5	Cont.	4-4½x5½	Dixie	.....	.....	Miller	Own	Own	worm	Timkn.	Ross
Moreland, 17-C	2½	3,775	36x4	36x7	Cont.	4-4½x5½	Dixie	.....	.....	Miller	Own	Own	worm	Timkn.	Ross
Moreland, 17-G	4	4,850	36x5	40x5d	Wauk.	4-4½x6½	Dixie	.....	Wauk.	Miller	Own	Own	worm	Timkn.	Ross
Moreland, 17-J	5	5,250	36x6	40x6d	Wauk.	4-4½x6½	Dixie	.....	Wauk.	Miller	Own	Own	worm	Timkn.	Ross
Muskegon, 20	2	2,325	36x4	36x6	Cont.	4-4½x5½	Eise.	none	Pierce	Stew.	Fuller	Fuller	in-g.	Torbn.	Lavn.
Myers, 50	1	1,495	34x4	34x4	Lyc.	4-3½x5	Delco	Dneto.	Pierce	Car.*	Mech.	Mech.	worm	Emp.	C.A.S.
Myers, 55	1	1,460	34x3½	34x4	Lyc.	4-3½x5	Delco	.....	Pierce	Car.*	Mech.	Mech.	worm	Emp.	C.A.S.
Myers, 70	1½	1,750	34x3½	34x5	Lyc.	4-3½x5	Delco	Dneto.*	Pierce	Car.*	B.&B.	G-Lees	worm	Emp.	C.A.S.
Myers, 75	1½	1,700	34x3½	34x5	Lyc.	4-3½x5	Delco	Dneto.*	Pierce	Car.*	B.&B.	G-Lees	worm	Emp.	C.A.S.
Nash, 2018	1	1,650	34x3	34x4	Own	4-3½x5½	Conn.	A-L.*	Duplx.	Strom.	B.&B.	Det.	in-g.	Clark	Jacox.
Nash, 4017	2	3,250	36x5	36x5	Buda	4-4½x5½	Eise.	Bijur*	Duplx.	Strom.	B.&B.	Own	in-g.	Own	Lavn.
Nash, 3018	2	2,175	34x4	36x5	Own	4-3½x5½	Conn.	A-L.*	Duplx.	Strom.	B.&B.	Det.	in-g.	Clark	Jacox.
Nelson & LeM., F	1	2,000	36x3	36x4	Cont.	4-3½x5½	Eise.	West.*	Mon.	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Nelson & LeM., F2	2	2,775	36x4	36x7	Cont.	4-4½x5½	Eise.	West.*	Mon.	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Nelson & LeM., F	3½	3,750	36x5	36x5d	Cont.	4-4½x5½	Eise.	West.*	Mon.	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Nelson & LeM	5	4,750	36x6	40x6d	Buda	4-4½x6	Eise.	West.*	Mon.	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Netco, D	2	2,500	36x4	36x6	Cont.	4-4½x5½	Eise.	none	.....	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Niles, B	1	1,500	35x5*	35x5*	Cont.	4-3½x5	Eise.	.....	Pierce	Strom.	Cover	Cover	worm	Timkn.	Gem.
Niles, E	2	2,400	36x4	36x7	Cont.	4-4½x5½	Eise.	.....	Pierce	Strom.	B.&B.	Cover	worm	Timkn.	Gem.
Noble, NW2	2½	2,675	36x4	36x7	Cont.	4-4½x5½	Eise.	Remy.	Pierce	Strom.	B.&B.	Fuller	worm	Shel.	Ross
Noble, NW4	4	3,750	36x5	36x5d	Cont.	4-4½x5½	Eise.	Remy.	Pierce	Strom.	B.&B.	Fuller	worm	Shel.	Ross
Norwalk, 2000	1	1,495	34x4*	34x4*	Lyc.	4-3½x5	Delco	Dneto.*	none	Car.*	B.&B.	G-Lees	worm	Emp.	C.A.S.
Norwalk, 3000	1½	1,750	34x4	34x5	Lyc.	4-3½x5	Delco	Dneto.*	none	Car.*	B.&B.	G-Lees	worm	Emp.	C.A.S.
O. K., 3T	1½	2,250	36x4	36x5	Buda	4-4½x5½	Eise.	none	Pierce	Zenith	Muncie	Muncie	worm	Chgo.	Ross
O. K., 1T	3½	2,985	36x4	36x7	Buda	4-4½x5½	Eise.	none	Pierce	Zenith	Fuller	Fuller	worm	Hays	Ross
Old Hickory, M		995	33x4*	33x4*	Lyc.	4-3½x5	Conn.	Dneto.*	.....	Car.	Lyc.	G-Lees	bevel	Salsby	C.A.S.
Sandow, G	1	.....	34x3	34x5	Cont.	4-3½x5	Eise.	.....	.....	Strom.*	Fuller	Fuller	worm	Shel.	Ross
Sandow, CG	1½	.....	34x3	34x5	Cont.	4-3½x5	Eise.	.....	.....	Strom.*	Fuller	Fuller	worm	Shel.	Ross
Sandow, H	1½	.....	34x4	34x6	Cont.	4-3½x5	Eise.	.....	.....	Strom.*	Fuller	Fuller	worm	Shel.	Ross
Sandow, J	2	.....	36x4	36x7	Cont.	4-4½x5½	Bosch	.....	Mon.	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Sandow, K	3½	.....	36x5	36x5d	Cont.	4-4½x5½	Bosch	.....	Mon.	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Sandow, L	5	.....	36x6	40x6d	Wauk	4-4½x6½	Bosch	.....	.....	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Sanford, 25	2½	3,000	36x4	36x4d	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B.&B.	Det.	worm	Shel.	Ross
Sanford, 35	3½	3,975	36x5	36x5d	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B.&B.	Warner	worm	Shel.	Ross
Sanford, 50	5	4,750	36x5	36x6d	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	B.&B.	Warner	worm	Shel.	Ross
Schacht	2	3,150	36x4	36x7	Buda	4-4½x5½	Bosch	none	Dup lx	Scheb.	Hart	Own	worm	Own	Own
Schacht	2½	3,500	36x4	36x4d	Buda	4-4½x5½	Bosch	none	Duplx.	Scheb.	Hart	Own	worm	Own	Own
Schacht	3½	3,950	36x5	36x5d	Buda	4-4½x5½	Bosch	none	Duplx.	Scheb.	Hart	Own	worm	Own	Own
Schacht	5	4,950	36x5	40x6d	Buda	4-4½x5½	Bosch	none	Duplx.	Scheb.	Hart	Own	worm	Own	Own
Schleicher	3	3,675	34x4½	34x3½d	Cont.	4-4½x5½	Bosch	.....	opt.	Strom.	.....	Own	chain	Own	.....
Schleicher	5	4,725	34x5	34x4d	Cont.	4-5 x6	Bosch	.....	.....	Strom.	.....	Own	chain	Own	.....
Selden, TXR	1	2,000	34x3½	34x5	Cont.	4-3½x5	Bosch	N-E*	Pierce	Strom.	B-Lipe	B-Lipe	in-g.	Russel	Lavn.
Selden, TWL	1	2,200	34x3	34x4	Cont.	4-3½x5	Bosch	N-E*	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Selden, TXL	1	1,650	34x3½	34x5	Cont.	4-3½x5	Bosch	N-E*	Pierce	Strom.	B-Lipe	B-Lipe	in-g.	Russel	Lavn.
Selden, JWB	2	2,850	36x4	36x7	Cont.	4-4½x5½	Bosch	N-E*	Pierce	Strom.	B-Lipe	B-Lipe	in-g.	Russel	Jacx.
Selden, NL	3½	3,050	36x4	36x7	Cont.	4-4½x5½	Bosch	N-E*	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Jacx.
Selden, DL	5	3,850	36x5	36x5d	Cont.	4-4½x5½	Eise.	N-E*	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Seneca, J	½	.....	30x3½*	30x3½*	LeR.	4-3½x4½	Remy	A -Ch.*	none	Scheb.*	Det.	Det.	bevel	Adams	Ditw.
Service, 320	1	2,100	32x3½	34x5	Buda	4-3½x5½	Eise.	West.	none	Strom.*	Fuller	Fuller	worm	Timkn.	Ross
Service, 340	2	3,000	36x4	36x7	Buda	4-4½x5½	Eise.	West.	Duplx.	Strom.	B.&B.	B-Lipe	worm	Timkn.	Ross
Service, 370	3½	3,900	36x5	36x5d	Buda	4-4½x5½	Eise.	West.*	Duplx.	Strom.	B.&B.	B-Lipe	worm	Timkn.	Ross
Service, 375	3½	4,200	36x5	36x5d	Buda	4-4½x6	Eise.	West.*	Duplx.	Strom.	B.&B.	B-Lipe	worm	Timkn.	Ross
Service, 400	5	5,000	36x6	40x6d	Buda	4-4½x6	Eise.	West.*	Duplx.	Strom.	B.&B.	B-Lipe	worm	Timkn.	Ross
Shaw, M-3	2	2,700	36x4	36x6	Cont.	4-4½x5½	Bosch	none	Pierce	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Gem.
Signa, F	1	2,400	34x3½	36x5	Cont.	4-4½x5½	Eise.	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Signa, H	1½	2,700	34x4	36x6	Cont.	4-4½x5½	Eise.	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Signa, J	2	3,100	34x4	36x8	Cont.	4-4½x5½	Eise.	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Signa, M	3½	4,100	36x5	40x5d	Cont.	4-4½x5½	Eise.	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Signa, R	5	5,100	36x6	40x6d	Cont.	4-4½x6	Eise.	none	.....	Strom.	B-Lipe	B-Lipe	worm	Timkn.	Ross
Standard, 70	2	2,800	36x4	36x6	Cont.	4-4½x5½	Eise.	none	Pierce	Scheb.	B.&B.	Covert	worm	Timkn.	Ross
Standard, 65	3½	3,675	36x5	36x5d	Cont.	4-4½x5½	Eise.	none	Pierce	Scheb.*	B.&B.	B-Lipe	worm	Timkn.	Ros
Standard, 85	5	4,650	36x6	40x6d	Cont.	4-4½x5½	Eise.	none	Pierce	Scheb.*	B.&B.	B-Lipe	worm	Timkn.	Ross
Steele, C	2	2,500	38x5	40x4d	Cont.	4-4½x5½	Eise.	.....	Own	Strom.	H-Shaw	Cotta	chain	Own	Ross
Steele, B	3	3,000	38x6	40x6d	Own	4-5 x5	Eise.	.....	Own	Strom.	H-Shaw	Cotta	chain	Own	Ross
Steele, BA	4	3,500	38x6	40x6d	Own	4-5 x5	Eise.	.....	Own	Strom.	H-Shaw	Cotta	chain	Own	Ross
Steele, A	5	4,000	38x7	40x6d	Own	4-5 x5	Eise.	.....	Own	Strom.	H-Shaw	Cotta	chain	Own	Ross
Sterling	2½	3,300	36x4	36x4d	Own	4-4½x5½	Eise.	.....	Wauk.	Zenith	B-Lipe	B-Lipe	worm	Shel.	Ross
Sterling	3½	4,325	36x5	40x5d	Own	4-4½x6½	Eise.	.....	Wauk.	Ray.*	H-Shaw	Own	worm	Timkn.	Ross
Sterling	5	5,100	36x6	40x6d	Own	4-4½x6½	Eise.	.....	Wauk.	Ray.*	H-Shaw	Own	worm	Timkn.	Ross
Sterling	7	5,600	36x6	40x7d	Own	4-4½x6½	Eise.	.....	Wauk.	Ray.*	H-Shaw	Own	worm	Timkn.	Ross
Stewart, 6	¾	.....	33x4*	33x4*	LeR.	4-3½x4½	Berl.	.....	.....	Zenith	Mech.	Mech.	in-g.	Clark	CAS
Stewart, 8	1	.....	34x3½	34x4	Cont.	4-3½x5	Berl.	.....	.....	Zenith	B.&B.	Fuller	in-g.	Clark	Gem.
Stewart, 9	1½	.....	34x3½	34x4½	Cont.	4-3½x5	Berl.	.....	.....	Zenith	Fuller	Fuller	in-g.	Clark	Gem.
Stewart, 7	2	.....	34x4	34x4d	Cont.	4-4½x5½	Berl.	.....	Pierce	Zenith	Fuller	Fuller	in-g.	Clark	Ross
Stewart, 10	3½	3,500	36x5	36x5d	Cont.	4-4½x5½	Eise.	.....	.....	Zenith	Fuller	Fuller	in-g	Clark	Ross
Studebaker, SF	¾	.....	35x4½*	35x4½*	Own	4-3½x5	Remy	Wag.*	.....	Scheb.*	Own	Own	bevel	Own	Gem..
Studebaker, 7	1	.....	35x5*	35x5*	Own	4-3½x5	Remy	Wag.*	Pierce	Scheb.*	Own	Own	bevel	Own	Gem.
Sullivan, F	1½	2,350	36x3	36x5	Buda	4-3½x4½	Bosch	.....	.....	Strom.*	Hart	Covert	worm	Timkn.	Ross
Sullivan, E	2	2,850	36x4	36x6	Buda	4-3½x4½	Bosch	.....	.....	Strom.*	B-Lipe	B-Lipe	worm	Timkn.	Ross
Superior, A	1	1,600	34x3½	34x4*	Own	4-3½x5	Eise.	none	Mon.	Strom.*	Fuller	Fuller	in-g.	Torbn.	CAS
Superior, C	2	2,200	36x4	36x6	Own	4-3½x5	Eise.	none	Mon.	Strom.*	Fuller	Fuller	in-g.	Torbn.	Ross
Texan	1½	1,375	34x4*	34x4	Lyc.	.....	.....	Dneto.*	.....	.....	.....	Muncie	worm	Chgo.	.....
Tiffin, A	¾	1,100	35x4½	35x4½*	Cont.	4-3½x5	Bosch	none	none	Scheb.	Det.	Det.	in-g.	Russe	Lavn.
Tiffin, GW	1½	2,075	36x3½	36x5	Cont.	4-3½x5½	Bosch	none	Pierce	Scheb.	Fuller	Fuller	worm	Shel.	Ross
Tiffin, MW	2½	2,750	36x4	36x3½d	Cont.	4-4½x5½	Bosch	none	Pierce	Scheb.	Hart	Covert	worm	Timkn.	Ross
Tiffin, PW	3½	3,600	36x5	36x5d	Cont.	4-4½x5½	Bosch	West.*	Pierce	Scheb.	B.&B.	Covert	worm	Shel.	Ross

Abbreviations: **Engine**—Wauk., Waukesha; Cont., Continental; H-S, Herschell-Spillman; Lyc., Lycoming; N.A., North American; Herc., Hercules; Mil., Milwaukee; Wis., Wisconsin; LeR., LeRoi; GBS, Golden, Belknap & Swartz; Beav., Beaver. **Ignition**—Eise., Eisemann; A-K, Atwater Kent; Koko., Kokomo; Split., Splitdorf; Conn., Connecticut; Lau., Lauraine; Berl., Berling; A-L, Auto-Lite. **Electric Lighting**—Nlite, Nicolite; G&D, Gray & Davis; A-L, Auto-Lite; Dneto., Dyneto; Al-Ch., Allis-Chalmers; West., Westinghouse; L-N, Leece-Neville; Det., Detroit; N-E, North East; Wag., Wagner; Asterisk, electric Starting also. **Governor**—Wauk., Waukesha; Duplx., Duplex; Cont., Continental; Mon., Monarch; Simplx., Simplex; McCan., McCanna; Rugles, Ruggles. **Carbureter**—Scheb., Schebler; Strom., Stromberg; Ray., Rayfield; King., Kingston; Mon., Monarch; Shake., Shakespeare; Car., Carter; Flech., Fletcher; Holl., Holley; Ens., Ensign; Mast., Master; John., Johnson; Stew., Stewart; Till., Tillotson; Asterisk, vacuum fuel feed. **Clutch**—B.&B., Borg & Beck; B-Lipe, Brown-Lipe; Det., Detroit; H-Shaw, Hele-Shaw; Mech., Mechanics; M&E, Merchant & Evans; Lyc., Lycoming. **Gearset**—B-Lipe, Brown-Lipe; G-Lees, Grant-Lees; Det., Detroit; Mech., Mechanics; Cover., Covert; Savg., Savage Arms. **Final Drive**—in-g., internal gear; d-rd., double reduction; s-bev., spiral bevel; ext-g., external gear. **Axle**—Tinkn., Timken; Torbn., Torbenson; Key-H, Keystone-Hindley; Shel., Sheldon; Salsby., Salisbury; Ind., Industrial; Chcgo., Chicago-Standard; Chgo., Chicago; W-W, Walker-Weiss; Emp., Empire. **Steering Gear**—Gem., Gemmer; Lavn., Lavine; Warn., Warner; Ditw., Ditweiler; Jacx., Jacox; Fost., Foster; Wol., Wohlrab. **Tires**—Asterisk, pneumatic.

Name and Model	Tons Capacity	Chassis Price	Front Tires	Rear Tires	Name of Engine	No. Cyl., Bore and Stroke	Ignition	Electric Lighting	Governor	Carbureter	Clutch	Gearset	Final Drive	Axle	Steering Gear
Old Rel'ble, W-15	1½	2,350	34x3½	36x6	Wis.	4-4 x5	Bosch	opt.	Mon.	Ray.*	B-Lipe	B-Lipe	worm	Shel.	Ross
Old Rel'ble, W-25	2½	3,250	36x4	36x4d	Wis.	4-4½x6	Bosch	opt.	Mon.	Ray.	Fuller	Fuller	worm	Shel.	Ross
Old Rel'ble, W-35	3½	4,000	36x5	36x5d	Wis.	4-4½x6	Bosch	opt.	Mon.	Ray.	Univ.	Savg.	worm	Shel.	Ross
Old Rel'ble, W-50	5	5,000	36x6	40x6d	Wis.	4-5.1x5½	Bosch	opt.	Duplx.	Strom.	Univ.	Savg.	chain	Shel.	Ross
Old Rel'ble, C-50	5	5,000	36x6	36x6d	Wauk.	4-4½x6½	Bosch	none	Wauk.	Strom.	Univ.	Savg.	chain	Shel.	Ross
Old Rel'ble, C-70	7	6,000	36x6	40x7d	Wauk.	4-4½x6½	Bosch	none	Wauk.	Strom.	H-Shaw	Cotta.	worm	Timkn.	Ross
Oneida, A	1	2,290	36x3½	36x5	Cont.	4-3½x5½	Bosch	West.	Pierce	Strom.	H-Shaw	Cotta.	worm	Timkn.	Ross
Oneida, B	1½	2,650	36x3½	36x6	Cont.	4-4½x5½	Bosch	West.	Pierce	Strom.	H-Shaw	Cotta.	worm	Timkn.	Ross
Oneida, C	2	3,000	36x4	36x7	Cont.	4-4½x5½	Bosch	West.	Pierce	Strom.	H-Shaw	Cotta.	worm	Timkn.	Ross
Oneida, D	3½	3,700	36x5	36x5d	Cont.	4-4½x5½	Bosch	West.	Pierce	Strom.	H-Shaw	Cotta.	worm	Timkn.	Ross
Oneida, E	5	4,750	3ox6	40x12	Cont.	4-5½x5½	Conn.	A-L.*	.....	Till.*	Own	Own	bevel	Own	Own
Overland, Panel	2⅝	835	31x4*	31x4*	Own	4-3⅜x5	Conn.	A-L.*	.....	Till.	Own	Own	s-bev.	Own	Own
Overland, Exp	2⅝	1,015	33x4½*	33x4½*	Own	4-4½x4½							worm	Own	Own
Packard, E	1	2,650	34x3½	34x6	Own	4-4 x5½	Split.	Bijur*	Own	Own	Own	Own	worm	Own	Own
Packard, E	1½	3,000	34x3½	34x3½d	Own	4-4 x5½	Split.	Bijur*	Own	Own	Own	Own	worm	Own	Own
Packard, E	2	3,400	34x4	34x4d	Own	4-4 x5½	Split.	Bijur*	Own	Own	Own	Own	worm	Own	Own
Packard, E	3	4,100	36x5	36x5d	Own	4-4½x5½	Split.	Bijur*	Own	Own	Own	Own	worm	Own	Own
Packard, E	4	4,450	35x5	40x5d	Own	4-4½x5½	Split.	Bijur*	Own	Own	Own	Own	worm	Own	Own
Packard, E	5	5,150	36x6	40x6d	Own	4-5 x5½	Split.	Bijur*	Own	Own	Own	Own	worm	Own	Own
Packard, E	6	5,400	36x6	40x7d	Own	4-5 x5½	Bosch	.....	Pierce	Strom.	Fuller	Fuller	in-g.	Timkn.	Ross
Packard, E	7	1,585	34x3½	34x4	Cont.	4-3⅜x5	Bosch	.....	Pierce	Strom.	Fuller	Fuller	worm	Timkn.	Ross
Palmer	1	2,275	30x3½	36x4d	Cont.	4-4½x5¼	Bosch	.....	.....	Scheb.*	Fuller	Fuller	in-g.	Torbn.	Lavn.
Palmer	2	1,195	32x3½	32x3½	Gray	4-3½x5	A-L	A-L	.....	Scheb.*	Fuller	Fuller	in-g.	Torbn.	Lavn.
Panhard, A	1	1,395	32x3½	32x4	Gray	4-3½x5	A-L	A-L	.....	Strom.	B-Lipe	Own	worm	Own	Ross
Panhard, B	1½	3,150	34x4	36x3½d	Cont.	0-3½x5½	Dixie	West.*	Pierce	Strom.	B-Lipe	Own	worm	Own	Ross
Parker	2	3,700	34x4	36x5d	Cont.	6-3½x5½	Dixie	West.*	Pierce	Strom.	B-Lipe	Own	worm	Own	Ross
Parker	3	4,250	36x5	40x5d	Cont.	6-3½x5½	Dixie	West.*	Pierce	Strom.	B-Lipe	Own	worm	Own	Ross
Parker	4	5,000	36x5	40x6d	Cont.	6-3½x5½			Pierce	Strom.*	.....	.....	.....	.....	.....
Parker	5	1,950	34x3½	34x5	Cont.	4-3½x5			Pierce	Strom.*	.....	.....	.....	.....	.....
Patriot	1½	2,750	34x4	34x7	Cont.	4-4½x5½			Own	Strom.	Own	Own	chain	Own	Own
Patriot	2½	4,125	36x4	40x4d	Own	4 4½x6½	Remy	none	Own	Strom.	Own	Own	chain	Own	Own
Peerless, TC	3	4,150	36x5	40x5d	Own	4-4½x6½	Remy	none	Own	Strom.	Own	Own	chain	Own	Own
Peerless, TC	4	4,700	36x6	40x6d	Own	4-4½x6½	Remy	none	Own	Strom.	Own	Own	worm	Own	Own
Peerless, TC	5	3,750	30x4	36x4d	Own	4-4 x5½	Eise.	West.*	Own	Own	Own	Own	worm	Own	Own
Pierce-Ar., X-4	2	5,500	36x6	40x.d	Own	4-4⅞x6	Eise.	West.*	Own	Own	Own	Own	worm	Timkn.	Ross
Pierce-Ar., R-9	5		36x6	36x4d*	Own	4-4½x5½	Simms	.....	Pierce	King	Fuller	Fuller	worm	Timkn.	Ross
Power	2	.....	36x4*	36x4d*	Cont.	4-4½x5½									
Rainier, R-5	3½	1,250	33x4*	33x4*	Lgt.	4-3½x4½	Split.	none	none	Zenith	B-Li e	B-Lipe	worm	Timkn.	Lavn.
Rainier, R-2	3½	1,350	34x4*	34x4*	Lgt.	4-3½x4½	Split.	none	Mon.	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Lavn.
Rainier, R-4	3½	1,595	33x4*	34x4	Lgt.	4-3½x4½	Split.	none	Mon.	Zenith	B-Lipe	B-Lipe	worm	Hayes	Lavn.
Rainier, R-6	1½	1,890	34x3	34x4	Cont.	4-3½x5½	Simms	none	Mon.	Zenith	B-Lipe	B-Lipe	worm	Chgo.	Lavn.
Ren.-Leslie, M	2½	2,895	36x5	36x7	Buda	4-4½x5½	Split.	West.	Pierce	Strom.	Warner	Warner	worm	Hayes	Lavn.
Ren.-Les'ie, B	8	2,895	36x5	36x7	Buda	4-4½x5½	Split.	West.	Pierce	Strom.	Warner	Warner	worm	Hayes	Lavn.
Reo, F	3	1,250	34x4½*	34x4½*	Own	4-4½x4½	Remy	Remy*	none	John.	Own	Own	s-bev.	Own	Own
Republic, Desp	3	1,095	32x3	32x3½	Own	4-3½x5	Remy	Remy	Rugles	Strom.	Own	Own	in-g.	Torbn.	Jacx.
Republic, 9 Sp	3	1,295	32x3	32x4	Own	4-3½x5	Eise.	none	Rugles	Strom.	Own	Own	in-g.	Torbn.	Jacx.
Republic, 10	1	1,485	34x3	34x4	Cont.	4-3½x5	Eise.	none	Rugles	Strom.	Own	Fuller	in-g.	Torbn.	Jacx.
Republic, 11X	1½	1,775	34x3½	34x5	Cont.	4-3½x5	Eise.	none	Rugles	Strom.	Fuller	Fuller	in-g.	Torbn.	Jacx.
Republic, 12X-A	2	2,150	34x4	34x6	Buda	4-4½x5½	Bosch	none	Rugles	Strom.	Fuller	Fuller	in-g.	Torbn.	Jacx.
Republic, TX	3½	3,450	36x5	36x5d	Buda	4-4½x5½	Bosch	none	Rugles	Strom.	Fuller	Fuller	in-g.	Torbn.	Jacx.
Riker, B	3	.....	36x5	36x5d	Own	4-4½x6	Berl.	West.*	Own	Own	Own	Own	worm	Own	Ross
Riker, BB	4	.....	36x5	36x6d	Own	4-4½x6	Berl.	West.*	Own	Own	Own	Own	worm	Timkn.	Ross
Rowe, CDW	2½	3,000	34x4	36x7	Wis.	4-4 x5	Bosch	none	Duplx.	Zenith	B-Lipe	B-Lipe	worm	Shel.	Ross
Rowe, CDW	3	3,250	34x4	36x4d	Wis.	4-4 x5	Bosch	none	Duplx.	Zenith	B-Lipe	B-Lipe	worm	Shel.	Ross
Rowe, DEW	5	3,800	30x5	36x5d	.....	4-4 x6	Bosch	none	Duplx.	Zenith	B-Lipe	B-Lipe	worm	Shel.	Ross
Rowe, FW	5	4,900	36x6	40xbd	Wis.	4-4½x5½	Bosch	.....	Duplx.	Zenith	B-Lipe	B-Lipe	worm	Shel.	Ross
Royal	1	2,400	34x4	34x5	Wis.	4-3½x5	Bosch	opt.*	Mon.	Strom.	B.&B.	Own	worm	Timkn.	Ross
Royal	1½	2,800	34x4	34x5	Wis.	4-3½x5	Bosch	opt.*	Mon.	Strom.	B.&B.	Own	worm	Timkn.	Ross
Royal	2	3,200	36x4½	36x6	Wis.	4-4 xb	Bosch	opt.*	Mon.	Strom.	B.&B.	Own	worm	Timkn.	Ross
Royal	2½	3,500	36x4½	36x6	Wis.	4-4½xb	Bosch	opt.*	Mon.	Strom.	B.&B.	Own	worm	Timkn.	Ross
Royal	3½	4,200	36x5	38x5d	Wis.	4-4½x6	Bosch	opt.*	Mon.	Strom.	H-Shaw	Own	worm	Timkn.	Ross
Royal	5	5,000	36x6	40x6d	Wis.	4-4½x5½	Bosch	opt.*	Mon.	Strom.	H-Shaw	Own	worm	Timkn.	Ross
Royal	6	5,400	36x6	40x6d	Wis.	4-5½x6	Bosch	opt.*	Mon.	Strom.	H-Shaw	Own	worm	Timkn.	Ross
Royal	7	6,500	36x7	40x7d	Wis.	4-5½x7	Conn.	Split.*	.....	Carter	B.&B.	.....	bevel	Own	Lavn.
Rush, D	½	895	31x4	31x4	Lyc.	4-3½x5									

Name and Model	Tons Capacity	Chassis Price	Front Tires	Rear Tires	Make of Engine	No. Cyl., Bore and Stroke	Ignition	Electric Lighting	Governor	Carbureter	Clutch	Gearset	Final Drive	Axle	Steering Gear
Tiffin, RW	5	4,650	30x6	40x6d	Cont.	6-3½x5½	Bosch	West.*	none	Scheb.	B.&B.	Covert	worm	Shel.	Ross
Tiffin, SW	6	4,850	36x6	40x12	Cont.	6-3½x5½	Bosch	West.*	none	Scheb.	B.&B.	Covert	worm	Shel.	Ross
Titan, T	3½	4,300	36x5	40x5d	Buda	4-4½x6	Bosch	Bosch	Duplx.	Strom.	B.&B.	Cotta	in-g.	Clark	Lavn.
Titan, H	6	5,150	36x6	40x6d	Buda	4-4½x6	Bosch	Bosch	Duplx.	Strom.	B.&B.	Cotta	in-g.	Clark	Lavn.
Tower, F	2	2,975	36x4	36x7	Cont.	4-4½x5½	Bosch	none	Pierce	Strom.	Fuller	Fuller	worm	Timkn.	Ross
Tower, G	3½	4,100	3ox5	36x5d	Cont.	4-4½x5½	Bos'h	none	Pierce	Strom.	Fuller	Fuller	worm	Timkn.	Ross
Traffic	2	1,395	34x3	34x4	Gray	4-3½x5	Koko.	none	none	Carter	B.&B.	Cover.	in-g.	Russe.	Ditw.
Transport, N	5	2,750	34x3½	34x4d	.....	4-3½x5	Bosch	.....	Mon.	Zenith	.....	.....	worm	.....	.....
Triangle, A	1½	2,185	34x3½	34x6	Wauk.	4-3½x5½	Eise.	none	Wauk.	Strom.	Fuller	Fuller	in-g.	Clark	Gem.
Union, B	2½	2,375	36x4	36x7	Wis.	4-4 x6	Eise.	none	Duplx.	Scheb.	Fuller	Fuller	in-g.	Russel	Ross
U. S., E	2½	2,800	34x4	36x4d	Cont.	4-4½x5½	Eise.	.....	Pierce	Strom.	Hart	Cotta	chain	Own	Lavn.
U. S., H	2½	3,250	34x4	36x4d	Cont.	4-4½x5½	Eise.	.....	Pierce	Strom.	Hart	B-Lipe	worm	Shel.	Lavn.
U. S., D	3½	3,500	3ox5	36x5d	Cont.	4-	Eise.	.....	.....	Strom.	Hart	B-Lipe	chain	Own	Lavn.
U. S., J	3½	3,950	36x5	40x5d	Cont.	4-4½x5½	Eise.	.....	Wauk.	Strom.	B.&B.	B-Lipe	worm	Shel.	Lavn.
U. S., K	5	4,850	36x5	40x6d	Wauk.	4-4½x6½	Eise.	.....	Wauk.	Strom.	B.&B.	B-Lipe	worm	Shel.	Ross
United, AX	1½	.....	36x3½	36x6	Buda	4-3½x5½	Eise.	opt.	Simplx*	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
United, BX	2½	.....	36x4	36x7	Buda	4-4½x5½	Eise.	.....	Simplx*	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
United, CX	3½	.....	36x5	36x5d	Buda	4-4½x6	Eise.	.....	Simplx*	Strom.	B-Lipe	B-Lipe	worm	Shel.	Ross
United, VX	5	.....	36x5	40x6d	Buda	4-4½x6	Eise.	.....	Mon.	Zenith	Own	Own	worm	Own	Lavn.
Universal, G	1½	.....	34x3½	34x5	Buda	4-3½x5½	Eise.	.....	Mon.	Zenith	Own	Own	chain	Own	Lavn.
Universal, D	2	.....	36x5	36x4d	Own	4-4½x5½	Eise.	.....	Mon.	Zenith	Own	Own	chain	Own	Lavn.
Universal, L	3½	.....	36x5	36x5d	Buda	4-4½x5½	Eise.	.....	.....	.....	.....	.....	.....	.....	.....
Velie, 25B	2	2,950	36x4	36x7	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.*	B.&B.	B-Lipe	worm	Timkn.	Gem.
Velie, 26B	3½	3,900	36x5	36x5d	Cont.	4-4½x5½	Bosch	.....	Pierce	Strom.	B.&B.	B-Lipe	worm	Timkn.	Gem.
Vim, 21	½	945	31x4*	31x4*	Own	4-3 x4½	Split.	West.	.....	Zenith	Own	Own	bevel	.....	Jacx.
Vim, 25	1	2,195	34x3½	34x4	Cont.	4-3½x5	Split.	.....	Duplx.	Zenith	.....	.....	worm	Shel.	Gem.
Vim, 22	2	3,150	36x4	36x6	Herc.	4-3½x5½	Split.	.....	Duplx.	Zenith	.....	B-Lipe	worm	Shel.	Gem.
Vim, 23	3	3,950	36x4	36x4d	Herc.	4-4½x5½	Split.	.....	Duplx.	Zenith	.....	B-Lipe	worm	Shel.	Gem.
Walter, MO	3		40x4d	40x4d	Own	4-4½x6	.....	none	Own	Zenith	Own	Own	ext-g.	Own	Own
Walter, F	5	5,700	40x7	40x10	Own	4-4½x6½	Eise.	West.*	Own	H&N	Warner	Own	in-g.	Own	Own
Watson, Tractor	5	4,0503	4x4	36x5d	Cont.	4-4½x5½	Bosch	none	Pierce	B-Lipe	B-Lipe	Own	worm	Timkn.	Gem.
Weir-Smith	3½	.....	37x7	37x7	Cont.	4-4½x5½	Dixie	.....	.....	Zenith	Fuller	Own	worm	Timkn.	Ross
White, GBBE	2½	2,300	34x4½*	34x4½*	Own	4-3½x5½	Eise.	opt.*	none	Own	Own	Own	bevel	Own	Own
White, TBC	1½	3,300	36x3½*	36x3½d	Own	4-3½x5½	Eise.	opt.*	.....	Own	Own	Own	d-rd.	Own	Own
White, TJ	3	4,000	36x5	40x5d	Own	4-3½x5½	.....	.....	.....	Own*	Own	Own	d-rd.	Own	Own
White, TG	5	5,000	36x6	40x6d	Own	4-4½x5½	.....	.....	.....	Own*	Own	Own	d-rd.	Own	Own
White-Hi., H	1½	2,400	36x3½	36x5	Cont.	4-3½x5	Eise.	none	Pierce	Strom.*	Fuller	Fuller	worm	Timkn.	Ross
Wichita, A	1	1,850	36x3	36x4	Own	4-3½x5	Bosch	Bosch	none	Strom.	Own	Cover.	chain	Shel.	Ross
Wichita, K	1	2,000	36x3	36x4	Own	4-3½x5	Bosch	Bosch	none	Strom.	Own	Cover.	worm	Shel.	Ross
Wichita, L	1½	2,350	36x3½	36x5	Own	4-3½x5	Bosch	Bosch	none	Strom.	Own	Cover.	chain	Shel.	Ross
Wichita, B	2	2,500	36x3½	36x6	Own	4-3½x5	Bosch	Bosch	Wauk.	Strom.	Hart.	B-Lipe	worm	Shel.	Ross
Wichita, R	2½	2,950	36x4	36x7	Wauk.	4-3½x5½	Bosch	Bosch	Wauk.	Strom.	Harr,	B-Lipe	worm	Shel.	Ross
Wichita, O	3½	3,750	36x5	36x5d	Wauk	4-4½x5½	Bosch	Bosch	Wauk.	Strom.	Hart.	B-Lipe	worm	Shel.	Own
Wichita, Q	5	4,600	38x6	38x6d	Wauk	4-4½x5½	Bosch	none	Pierce	Strom.	B-Lipe	B-Lipe	worm	Shel.	Own
Wilcox, S	1	1,950	35x5*	35x5	Cont.	4-3½x5	Bosch	none	Pierce	Strom.	Own	Own	worm	Shel.	Own
Wilcox, X	1½	2,775	36x4	36x5	Own	4-4½x5	Bosch	none	Pierce	Strom.	Own	Own	worm	Shel.	Own
Wilcox, Q	2½	3,250	36x4	36x3½d	Own	4-4½x5	Bosch	.....	Pierce	Strom.	Own	Own	worm	Shel.	Own
Wilcox, P	3½	3,950	36x5	36x5d	Own	4-4½x5	Bosch	none	Wauk.	Strom.	Own	Own	worm	.....	Own
Wilcox, W	5	4,850	36x5	40x12	Wauk.	4-4½x6¾	Eise.	opt.	Pierce	Strom.	Own	Own	worm	.....	Own
Wilson	1	1,630	35x5*	35x5	Own	4 3½x5	Eise.	opt.	Pierce	Strom.	Own	Own	worm	.....	Own
Wilson	2	2,800	36x4	36x4d	Own	4 4½x5½	Eise.	opt.	Pierce	Marve	Own	Own	worm	.....	Own
Wilson	3½	3,800	36x5	36x5d	Own	4-4½x5½	Eise.	Bijur*	Simplx.	Mast.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Wilson	5	4,850	36x5	40x12	Own	4-4½x6¾	Eise.	Bijur*	Simplx.	Mast.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Winther, 38	1½	2,250	34x3½	34x6	Wis.	4-3½x5	Eise.	Bijur*	Simplx.	M .st.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Winther, 48	2	3,200	36x4	36x4d	Wis.	4-4 x6	Eise.	Bijur*	Simplx.	Mast.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Winther, 68	3	3,900	36x5	36x5d	Wis.	4-4½x6	Eise.	Bijur*	Simplx.	Mast.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Winther, 88	4	4,300	36x5	40x5d	Wis.	4-4½x5½	Eise.	Bijur*	Simplx.	Mast.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Winther, 108	5	5,000	36x6	40x6d	Wis.	4-5½x6	Eise.	Bijur*	Simplx.	Mast.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Winther, 128	6	5,250	36x6	40x12	Wis.	4-5½x6	Eise.	Bijur	Simplx.	Mast.*	B.&B.	B-Lipe	in-g.	Clark	Ross
Winther, 148	7	5,500	36x6	40x7d	Wis.	4-5½x6	Eise.	none	Wauk.	Mast.	Fuller	Fuller	worm	Shel.	Lavn.
Wisconsin, B	1½	1,750	34x3½	34x4	Wauk.	4-3½x5½	Eise.	none	Wauk.	Mast.	Fuller	Fuller	worm	Shel.	Lavn.
Wisconsin, C	2½	2,850	36x4	36x6	Wauk.	4-4 x5½	Eise.	.....	Pierce	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Witt-Will, WD-16	1	.....	36x3*	36x4*	Cont.	4-3½x5½	Eise.	.....	Pierce	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Witt-Will, WD-18	2½	.....	36x3½*	30x3½d	Cont.	4-4½x5½	Eise.	.....	Pierce	Zenith	B-Lipe	B-Lipe	worm	Timkn.	Ross
Wolverine, C	1½	2,180	34x3½	34x5	Cont.	4-3½x5	Split.	G&D*	Mon.	Flech.	Fuller	Fuller	in-g.	Russel	Gem.

Abbreviations: **Engine**—Wauk., Waukesha; Cont., Continental; H-S, Herschell-Spillman; Lyc., Lycoming; N.A., North American; Herc., Hercules; Mil., Milwaukee; Wis., Wisconsin; LeR., LeRoi; GBS, Golden, Belknap & Swartz; Beav., Beaver. **Ignition**—Eise., Eisemann; A-K, Atwater Kent; Koko., Kokomo; Split., Splitdorf; Conn., Connecticut; Lau., Lauraine; Berl., Berling; A-L, Auto-Lite. **Electric Lighting**—Nlite, Nicolite; G&D, Gray & Davis; A-L, Auto-Lite; Dneto., Dyneto; Al-Ch., Allis-Chalmers; West., Westinghouse; L-N, Leece-Neville; Det., Detroit; N-E, North East; Wag., Wagner; Asterisk, electric starting also. **Governor**—Wauk., Waukesha; Duplx., Duplex; Cont., Continental; Mon., Monarch; Simplx., Simplex; McCan., McCanna; Rugles, Ruggles. **Carbureter**—Scheb., Schebler; Strom., Stromberg; Ray., Rayfeld; King., Kingston; Mon., Monarch; Shake., Shakespeare; Car., Carter; Flech., Fletcher; Holl., Holley; Ens., Ensign; Mast., Master; John., Johnson; Stew., Stewart; Till., Tillotson; Asterisk, vacuum fuel feed. **Clutch**—B.&B., Borg & Beck; B-Lipe, Brown-Lipe; Det., Detroit; H-Shaw, Hele-Shaw; Mech., Mechanics; M&E, Merchant & Evans; Lyc., Lycoming. **Gearset**—B-Lipe, Brown-Lipe; G-Lees, Grant-Lees; Det., Detroit; Mech., Mechanics; Cover., Covert; Savg., Savage Arms. **Final Drive**—in-g., internal gear; d-rd., double reduction; s-bev., spiral bevel; ext-g., external gear. **Axle**—Timkn., Timken; Torbn., Torbenson; Key-H, Keystone-Hindley; Shel., Sheldon; Salsby., Salisbury; Ind., Industrial; Chcgo., Chicago-Standard; Cbgo., Chicago; W-W., Walker-Weiss; Emp., Empire. **Steering Gear**—Gem., Gemmer; Lavn., Lavine; Warn., Warner; Ditw., Ditweiler; Jacx., Jacox; Fost., Foster; Wol., Wohlrab. **Tires**—Asterisk, pneumatic.

The Readers' Clearing House

Questions and Answers

Conducted by B. M. Ikert

Old-Type Oiling

Q—Was there ever an oiling system which allowed the oil to be pumped through the feed pipes but once, then pass on to another section of the crankcase to be used as splash oil only?—Earl Barr, Monroe, Wash.

The old types of mechanical oilers supplied lubricant to the engine base in quantities that were supposed to correspond with the consumption, and they worked with a reasonable degree of satisfaction, except that their supply was limited.

Force-Feed Oil System

Q—Can a force-feed oil system be installed on a Ford, which will feed the main bearings and splash connecting rods? Who makes this and how can it be done?—Barney Jak, Cleveland, Ohio.

MOTOR AGE knows of no force-feed oiling system for the Ford car that can be found on the market. In MOTOR AGE for Sept. 12, 1918, was a description of such a device which any good mechanic can make and install and which has worked very successfully with those who have used it.

Parts May Be Worn

Q—The small bevel drive pinion in the differential of my Everitt 6-48 is continually shearing the key off on the main driveshaft. Why is this? Is this a weak point in this particular car?—Gaylord Kuestrick, Washington.

Either your shaft is out of line or the keyway is so worn that it permits play between the pinion and the shaft, causing the key to break when power is applied suddenly. It is also possible the pinion bearing is worn to such an extent as to permit the pinion to run out of true. This can be told only by an inspection of the parts. Your remedy will be a new bearing, a perfect lining up and possibly a new shaft so the key can be held rigidly in place.

Car Heats Up

Q—I have had trouble with my model N Hupmobile heating. Whenever I go 20 m.p.h. or more or get a hard pull the water will boil and will come out of the radiator cap. I have gone over the ignition carefully and am sure the timing is right. I also had the radiator thoroughly cleaned out to make sure the circulation was perfect. The hose also was renewed, and there is no carbon to speak of. I am using the regular 105 jets in the carbureter and even changed from 62-test to 70-test gasoline. The brakes are free, and the car can be pushed along with one finger. When not heated up too much the car runs perfectly but after a steady run of 2 or 3 miles the engine loses its pep. I am using Gargoyle A oil. This car always has heated up since I have had it, but I never used it very hard until this fall.—W. E. Pieper, Milwaukee, Wis.

Miscellaneous

Because of the fact that your car seems to run perfectly except for the heating trouble, it is evident the valve tming is correct, but it would be a good idea to check this up, which is easily done by following the marks on the flywheel. These will tell just where each valve opens and closes. Assuming this is right, that you have no restriction in the flow of water through the radiator, hose and water-jackets; that the brakes are free and the car may be pushed easily, it comes down to one of three things—carbureter adjustment, ignition timing or lack of lubrication. For the moment the latter may be dismissed, if oil does not drip on the floor and yet you are compelled to replenish the supply. Right here it may be suggested that you try an overdose of oil, causing the engine to smoke, just to see if this brings relief.

The ignition may be checked up in a few moments. Turn the engine over until the first piston in the No. 1 cylinder is at the top dead center on the compression stroke. If both valve tappets are free when the piston is up, then you will know it is on the compression stroke; otherwise turn the shaft over one complete revolution, until both valves are free. The piston in No. 1 cylinder should be raised to top dead center, which would be at a time when the mark "1 and 4-CL" on the flywheel registers with the dead center, which can be ascertained by removing the flywheel cover.

Set the hand spark lever in a horizontal or mid position on the sector and loosen the two nuts on the control rod at either side of the small swivel block at the igniter. The igniter should be turned so that the lug, to which the swivel connects, points directly away from the carbureter, and then carefully turn back about a sixth turn contrary to the direction of normal rotation of the distributer shaft, until a click is heard. Then clamp the adjustment in place. If the igniter has been properly set, the metal edge of the distributer block should be pointing toward the radiator.

Now try the car again, for it will give you an idea of what was the trouble. If it still exists then start in on the carbureter by adjusting for idling. You must remember that a mixture that is too lean or too rich will cause heating, because either will be a slow burning charge. Have the engine hot in making carbureter adjustment. Close the hand throttle and turn the knurled nut beside the float chamber until the engine runs smoothly. Turning to the right decreases the amount of air and to the left increases the amount of air. More air means a leaner mixture and less air a richer mixture.

If you still have not found a remedy, it is a service man's job and the seller ought to take some interest in the case if, as you say, the engine has always heated. He should have been consulted the moment the engine showed this inclination.

Dismantling Paige Clutch

Q—I have a five-passenger 1916 Paige which has a cork-insert clutch of fourteen plates. This has given me considerable trouble of late. I have been told there is a spring that connects the final drive which one has to be very careful of when taking off transmission.—Horao K. Ryan, Chicago.

It is a simple matter to dismantle a Paige clutch and you are correct in your surmise to a certain exent. Still, there is nothing to fear. By referring to Fig. 1 you will observe that the plate A is the one which must be removed, back of which is the spring mentioned. In taking off this plate turn off the nuts around the edge, ten in all, but be careful to take them off evenly, that is, do not take one completely off and then another. You can remove all but say four, opposite one another, and then back these off gradually and equally, so there will be ample surface to hold the plate. When you have the four almost off you can hold the plate with the two hands and have somebody else remove the four nuts or you can place your stomach against the plate and remove the nuts yourself. There will be a little jump to the plate, but it can easily be held.

Any round corks that are of sufficient diameter will be available for this work, but make sure a good quality of fine-grained cork is used, otherwise it may pulverize under the work it is called upon to do. It will be well to put the corks into hot water to soften them, so they will cut easily. Some shops use oil, but hot oil is dangerous to handle. The corks are then inserted in the holes in the plate B, as far as they can be pushed, and then are cut off on either side.

Up to this time the process is very simple—the real work begins with the cutting-off process, for it must be understood that one or two corks higher than their neighbors will carry all the load and may

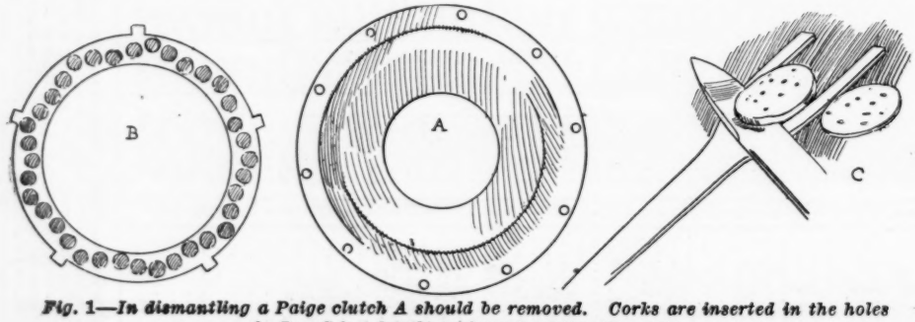


Fig. 1—In dismantling a Paige clutch A should be removed. Corks are inserted in the holes in B. C is a handy tool for inserting the cork

permit the plate to twist and not work effectively. Every cork should be so carefully trimmed so each will bear its proportionate share of the load of moving the car.

It will be well to make a little tool to accomplish this work, and once made it will come in handy as long as you have a car using cork inserts in the clutch plates. This can be made about as illustrated at C. This would consist of a thin fork, shaped so the fork part will fit around one cork. It should be scant $\frac{3}{16}$ in. thick, for the corks should be that much above the plate. By having the fork a scant $\frac{3}{16}$ in. thick and placed around the cork, a thin sharp knife may be used to shave off all but the scant $\frac{3}{16}$ in. of the cork and permit each to be even in height and to work satisfactorily when the clutch is placed back in the flywheel.

Salisbury Axle Adjustments

Q—Show adjustment of Salisbury axle on 1916 Marion, 6-60. It emits unusual noise and howls.—E. G. Hauser, Chicago.

You may have to adjust both pinion and ring gears to bring them into correct register, that is, to have their faces come together without one extending beyond the other. To adjust the pinion gear refer to Fig. 3 and then proceed as follows: First, remove cap B, which is held in place by two capscrews. This will expose the pinion shaft adjusting sleeve C, which has a right-hand thread. This can be turned to the right, to lower the pinion, depending upon the adjustment desired. The end thrust of the pinion shaft is taken up by the bearings N and O and the locknuts above these bearings prevent their turning.

The differential is shown in Fig. 2 and with this before you follow these instructions: First remove the locks D. This leaves the castellated adjustments E free to be moved in or out. They control the location of the differential assembly. The ball bearings, which carry the differential thrust, are located inside the adjusting nuts E. Split collars F, which holds the axle shaft in position, should be loosened to free the axleshaft in case the differential cannot be shifted readily. On reassembling, be sure that all locks, adjustments and covers are replaced and tightened up properly.

These two gears should be brought together so a cigaret paper will pass between them, when the driveshaft is turned, and will not be torn. In other words there should be no more and no less play than is represented by the thickness of the cigaret paper.

Kerosene for Cooling

Q—Is kerosene practical to use in the cooling system and safe in the radiators of motor cars? —J. E. Chapman, LaSalle, N. Y.

The coming of a number of anti-freezing solutions, right on the heels of the higher prices for glycerin and denatured alcohol, has upset the minds of motorists as to what is best to use to head off Jack Frost and prevent a rush to repairers of radiators and the buying of new cylinder blocks.

No two people agree on what is best to use, yet all agree that alcohol has always served its purpose and would still if it were not for the uncertainty of the exact state of the mixture.

There seems to be some hesitancy about buying and using prepared solutions, despite the fact that some makers put out strong guaranties and have reputations and means to back up these warranties.

It must be admitted there is a strong tendency to use kerosene, despite there are objectionable features about it. The trouble is that driving conditions are so vastly different that what will do in one case is all wrong in another.

This deals not with alcohol, glycerin or the prepared anti-freezing solutions—it is all about kerosene, and the experience of one man in particular who has made tests and who saw others use it all during a long and cold winter, that of 1917-1918.

It was not pure kerosene that was used but a mixture of two-thirds kerosene and a third light lubricating oil, such as any motorist would use in his engine in the summer.

It will be remembered that just a year ago transportation was in a badly crippled state; that the Government frowned upon passenger travel; that soldiers could not go here or there because it interfered with traffic—and so they were denied Thanksgiving dinners in some instances because they could not be transported.

In one instance a motor car manufacturer who had a heart for the boys turned every available car in the place into a soldier-carrying vehicle and had his men drive 200 miles to a cantonment and haul as many boys as possible to his home town for the big feed of the year.

It was cold weather, and the roads were in bad condition, yet the trip was made.

Every car was provided with some sort of anti-freezing mixture and half a dozen kinds were used. Naturally, alcohol predominated, but at least two cars had the mixture of kerosene and lubricating oil to protect their cooling systems.

The driver of one of these two cars made the statement to a MOTOR AGE representative only during the last week that the 200-mile run was made just as fast as road conditions would permit; that while these cars had not the least trouble some of the others did with the cooling systems. Again, he stated that this combination had been used all last winter and that never did he encounter trouble and he gave it his endorsement, particularly where anything but very long and excessively fast driving might be required.

It must be remembered that kerosene boils at about 350 deg. Fahr., but, of course, the lubricating oil would alter this somewhat and it might be possible to have the engine excessively hot and still the oil would not boil, whereas damage might come to the engine. For short runs and frequent stops, with no excess of speed, or during very cold weather, the combination of oil might work out satisfactorily. But when a comparatively warm day might come it would be necessary to alter conditions. This would not be difficult, however, for the oil could be drawn off and plain water substituted until the weather became colder.

One thing is necessary—as found in the instance related. To prevent the rubber from getting into the radiator because of disintegration, spiral springs were inserted in the hose. This kept the hose bulged out to capacity, whereas it might collapse and cause a stoppage of the liquid. This was the procedure in the case mentioned, and, as claimed, no trouble was encountered with its use all of last winter.

If the hose is covered thoroughly with two coats of shellac, each permitted to dry before the other is applied, it will prevent the oil from attacking the rubber, to a large extent.

His Clutch Grabs

Q—My Mitchell six seems to run good, except when ascending a long hill and going slow at the top; it jumps along as a car does when it misses on one cylinder. It is a light six-cylinder, 1914. The clutch has been grabbing, but I have found the trouble. On account of the clutch grabbing it has jerked the surfaces between the slots on the end of the axle shaft forward about $\frac{1}{8}$ in. Would it be well to reverse the two axles to make it pull back?

2—What is the best outfit for charging eight or ten 6-volt batteries, the rectifier or the motor-generator set?—R. B., Tiffin, Iowa.

1—You do not state whether the difficulty of jerking has been overcome, al-

TO assist readers in obtaining as a unit all information contained in this department on a certain subject MOTOR AGE segregates inquiries into divisions of allied nature. Questions pertaining to engines are answered under that head, and so on.

MISCELLANEOUS

Earl Barr.....Monroe, Wash.
Barney Jak.....Cleveland, Ohio
Gaylord Kuestrick.....Washington
W. E. Pieper.....Milwaukee, Wis.
Horao K. Ryan.....Chicago
J. E. Chapman.....LaSalle, N. Y.
R. B.....Tiffin, Ohio
John Byrne.....Miranda, S.D.
Houstonia Garage Co.....
.....South Charleston, Ohio
G. L.....Farrell, Pa.
E. A. Jones.....Evansville, Ind.

THE ELECTRIC SYSTEM

L. E. Bercaw.....Hinsdale, Mont.
L. Boddeker.....Galveston, Tex.
J. W. Jones, Jr.....Greenville, S. C.

ENGINES

Carl Oldham.....Chicago
Reader .....Washington
W. X. F.....Metamora, Ohio
Ralph M. Osborn.....Brewster, Kan.
O. B. Galagher.....San Antonio, Tex.
Carlos E. Ellis.....Rochester, Minn.
H. Stamps, Jr.....
.....Galbraith Springs, Tenn.
G. A. Swanson.....Craig, Neb.
C. D. Meyer.....Seattle, Wash.

REBUILDING

Gorman Motor Co.....Joplin, Mo.
V. Steinborn.....Chicago
G. A. Tanguay....Quebec City, Quebec
Everett Moody.....Muncie, Ind.
U. L. Jones.....Kelly Field, Tex.

No communication without the writer's name and address will be answered in these columns.

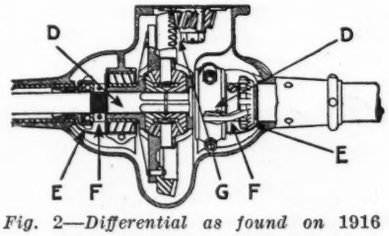


Fig. 2—Differential as found on 1916 Marion, showing adjustments

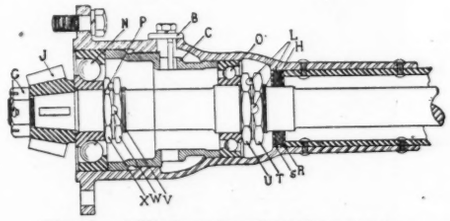


Fig. 3—Adjustments of pinion gear on Salisbury axle on 1916 Marion

though it might be presumed you meant the clutch was the cause of the trouble. If this still exists and it is not the clutch, look to the carbureter adjustment. Your description would lead one to believe the mixture too rich or the float level too high.

By reversing the driveshafts you would soon put them entirely out of commission, for these parts have been badly strained and probably if a careful examination is made you will see the fractures. It would be wise to put in new ones, else some day you will be in a hard pull and will strip them entirely and will be left without means of propelling the car. If anything, they should be heated and worked back to their original place, but this will prove a delicate undertaking.

2—Either charging set will give satisfaction.

Two- and Four-Passenger

Q—We have a car that is very hard on the front springs. Would snubbers keep the springs from breaking?

2—I have heard that the Paige company makes a roadster that can be changed from a four-passenger to a two-passenger. How is this done?—John Byrne, Miranda, S. D.

1—Yes, any shock absorber will prevent this to a large extent but is not an absolute guaranty against breakage. Snubbers do not prevent the body of the car from going down but do check the rebound, and that is what breaks springs.

2—The Paige roadster mentioned is built with a large rear deck, so that when the car is used as a two-passenger affair the deck is folded down and when it is desired to use it to carry four persons the deck cover is opened, and the seats that fold down are raised and locked in place. A top is made in sections to be used either for the two-passenger or four-passenger equipment. It is a handy device and serves well the purpose. The car is shown in Fig. 4.

Front Spring Bolts

Q—We have trouble with the front spring bolts on Fords breaking and letting the spring leaves apart so that they break. How can we remedy this?—Houstonia Garage Co., South Charleston, Ohio.

If you mean the spring bolts that go through the eyes on the ends of the springs and are attached to the shackles, which in turn are linked to the bosses on the upper side of the axle, it is probable these various connections have become so worn that they permit misalignment. Again, if the radius rods have been slightly buckled or are not in adjustment, this will permit lateral movement of the spring and cause breakage. It would be well to be sure that the spring-clips which hold the spring to the frame are thoroughly turned up so as to permit no movement of the spring at this point. To take out the looseness at the spring eyes it may be necessary to insert new bushings and new spring bolts. If all these parts are tight and the radius rods properly adjusted, there should be no occasion for spring breakage.

Relining a Clutch

Q—What kind of cork would you use to reline a clutch? Would you use cork out of a bottle, and how?—G. L., Farrell, Pa.

The corks in the clutch plates need renewing and will require what are known technically as ½-in. corks. The ordinary bottle corks will be all right, if of good quality; that is, firm and not apt to pulverize readily. You will have to dismantle the clutch to get at the plates. Before putting the corks into the plates soak them in hot water. They should be forced through sufficiently to allow $\frac{3}{16}$ in. on either side of the plate after being trimmed off. It will require a sharp, thin-bladed knife to trim the corks, and you should lay alongside each cork a piece of $\frac{3}{16}$-in. metal as a guide, so each cork will be the same height. Still better would be a fork-shaped piece $\frac{3}{16}$-in. thick in which the cork should be placed so it can be cut off evenly.

Forces in Airplane

Q—When an airplane is in the air may it be considered as a free body so far as the following forces are concerned, the force turning the propeller, the force counteracting this force? What steps in design or operation have been taken to get the second force?—E. A. Jones, Evansville, Ind.

When an airplane is flying horizontally at uniform speed it is acted upon by three forces, namely, the forward thrust of the propeller, the force of gravity and the reaction of the surfaces moving against the air, in other words, the air resistance. The reaction between the moving wings and the air is at right angles to the chord plane of the wings. As the wings are given a certain angle of incidence—angle between propeller axis and so-called neutral plane of wings—this force makes a slight angle with the horizontal component or drift and a vertical component or lift. Naturally the lift must be exactly equal to the weight of the plane with load. The elevators enable the pilot to instantly change the ratio of lift to drift.

Lift is produced only by the wing surfaces, but the other parts of the structure, such as the fuselage, struts, etc., produce a resistance to the motion of the plane, known as parastic resistance.

The lift and drift characteristics of various wing shapes and the parasitic resistance of various forms of fuselages is determined carefully by tests of small-scale models of these forms in wind tunnels. In these tunnels a wind of almost any velocity can be created by blowers. The model then is introduced into the tunnel through an opening in the side. It is supported on a rod and the reaction of the wind on the model is transmitted by the rod to a scale.

Very extensive wind tunnel experiments were made before the war by the French engineer, Eiffel, and his results were published in the form of an atlas. The United States National Advisory Committee for Aeronautics also has published a bulletin on wind tunnels and wind tunnel experiments.

The Electric System

Water Resistance for Charging

Q—I have a Gray & Davis starter taken from the model 79 Overland. Would it be possible to change this to a direct-current generator?

2—How can we put water resistance into a 110-volt direct current generator for charging batteries? We have been using the house lights, but this is unsatisfactory.

3—How can the charging rate be raised in an Auto-Lite generator on a model 85 Overland? It will not generate more than 10 amp., which

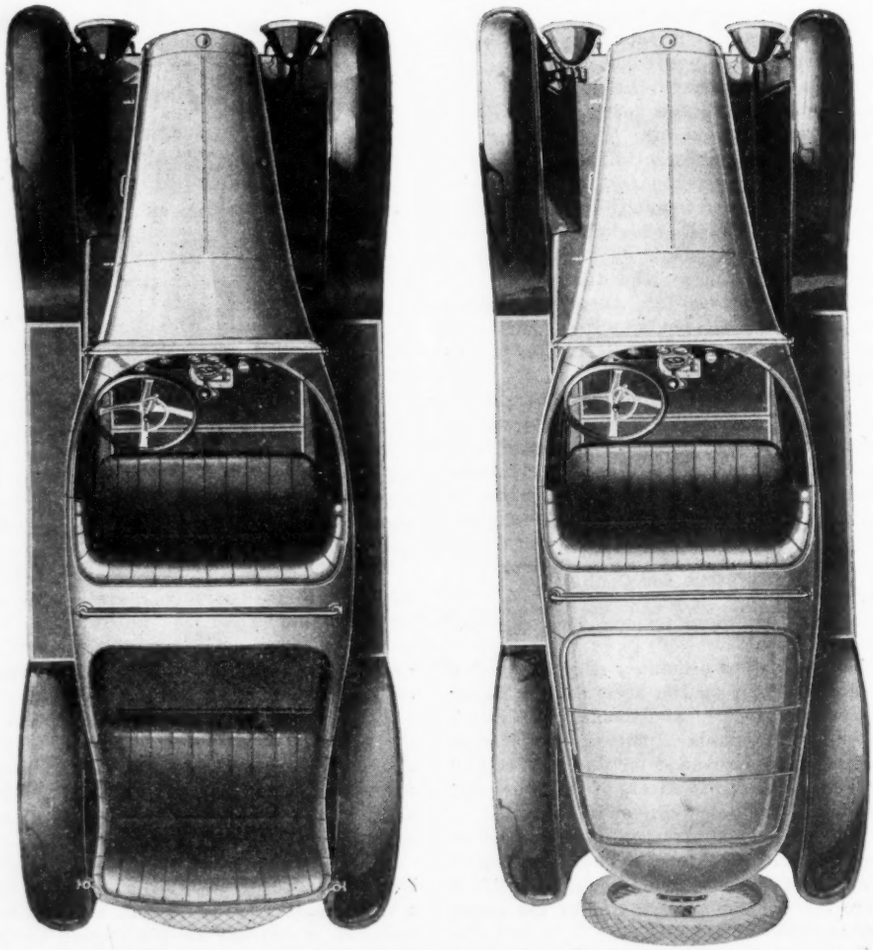


Fig. 4—Airplane views of Paige model 51 four-seater convertible roadster

is not enough for the cold weather we have.—L. E. Bercaw, Hinsdale, Mont.

1—Not unles it is rewound and this will call for the work of an expert in this direction. It probably would be cheaper and more satisfactory to turn the motor in on a generator.

2—Provide anything that will hold water—a pail of 3 or 4 gal. capacity. A metal pail will do, provided the wires are not permitted to touch the metal. For convenience, you can lay a stick across the top of the pail, as shown in Fig. 5a, and wrap the wires around the stick to support them and hold them in place and to permit their being moved. Use the wires connected with the lamps and immerse the ends. By varying the distance between the wires the flow of current can be regulated.

A still better device is shown in Fig. 5 and will serve as a time saver if you have much use for the idea. Make a water-tight rectangular box with a 4- or 5-gal. capacity; arrange across it a stick about 2 in. wide and 1 in. thick and through the center cut a slot the entire length. Two metallic plates with binding posts on top and arranged to slide in the slot in the stick are to be suspended in the water, and to the binding posts the wires are to be attached. This will make it handy to attach the wires, and the plates can be moved apart or nearer together at will. While the wires immersed in the water will work successfully, the plates will give better results.

3—Remove the small brass cover plate from the side of the generator, when it will be noticed that the brush holders are fastened to a ring in the end of the generator. Loosen the screws which hold the ring in place from the outside and turn the ring in the direction which the armature rotates when the engine is running. By this means the output can be raised to about 14 amp.

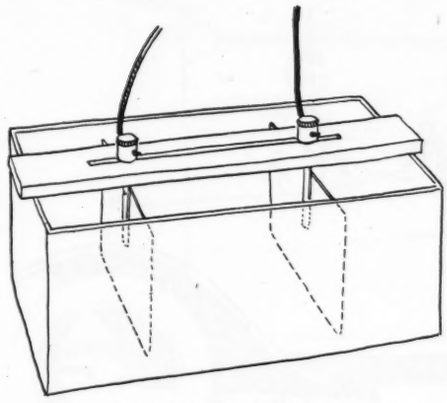


Fig. 5—Water-tight rectangular box for water resistance

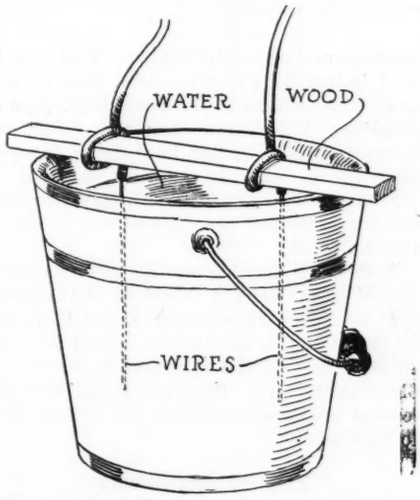


Fig. 5a—Everyday apparatus for inserting water resistance in charging

Connections of Windings

Q—Are the primary and secondary winding on a high-tension magneto connected together?

2—To what winding is the condenser connected?—L. Boddeker, Galveston, Tex.

1—No, not so that there is any current flow between them. However, they usually are connected at one end through a common terminal to ground.

2—In the primary.

Wiring of 490 Chevrolet

Q—Publish wiring diagram of Chevrolet 490.—J. W. Jones, Jr., Greenville, S. C.

This diagram is given in Fig. 6 and shows the two-wire system used on some of the Chevrolet cars.

Engines

Scavenging Burnt Gases

Q—Would a complete scavenge of the burnt gases in an engine be a benefit in additional mileage and cause less carbon deposits? Would this give more power on less gasoline?—P. H. Guiles, Abilene, Kan.

With such a condition the millennium would be almost reached. Motor car makers and engine manufacturers have been striving for years to reach this point but so far have failed. It is true that conditions are being bettered, and every once in a while some device is brought out with the purpose of preventing carbon deposits. No way has yet been found in perfectly scavenging an internal combustion engine, but those of the high compression type, such as the Diesel, where clean air is drawn into the cylinder and the fuel injected by pressure, instead of depending upon carburetion, come nearer meeting the conditions named than any others and it is not impossible that at some future time some such type of engine will be used in motor cars, trucks and tractors.

There are many schemes to inject moisture, which tend to prevent carbon deposits from forming and assist in combustion and the use of hot spots and similar devices also aid by more completely volatilizing the fuel, thus permitting it to be burned, but complete scavenging is not for the present except as noted.

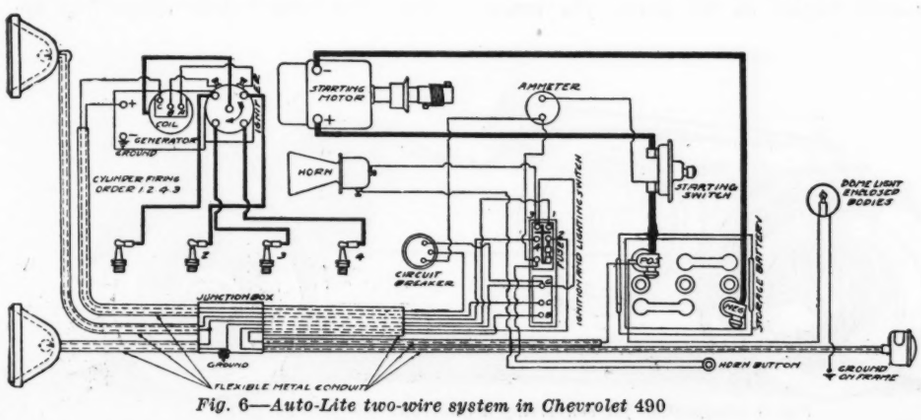


Fig. 6—Auto-Lite two-wire system in Chevrolet 490

Loose Crankshaft Bearings

Q—Aug. 25 I wrote you in regard to engine bearings on a Chalmers 36-4, unit powerplant, since answered in MOTOR AGE. Your answer was on plain babbitt bearings, with which I am familiar. This engine has balls running in a race at the front and rear of the crankshaft with adjustment between the flywheel and on the rear compartment of the crankcase.

2—I removed the transmission, lower crankcase, radiator, timing gear case, etc., on this engine and found an adjusting ring held by a lock and screw. The only way I could see to get at this adjusting ring was to remove the flywheel, which I could not do. I took a piece of steel ½ by 10 by 4 in. and drilled two holes in it, 8 in. apart, for ¾-in. bolts. I heated them in a fire and bent a hook on each. These I put in the flywheel which has two holes 1¼ in. in diameter, put on the 10-in. bar and screwed up the nuts. This bent the bar, so I put in a ⅝-in. bar between the crankshaft and the ½-in. bar, but it bent both of them. Then we reassembled it and with all the twisting, pulling and hammering. It must have tightened up, for when we ran the engine again most of the noise was gone. Now, however, the noise is worse than ever. Should this flywheel be taken off? It seems to be sweated on with a Woodruff key. Would heating it with a blow torch and the puller get it off or must it be pressed off? We have no press. The aluminum case covers the flywheel, so we cannot get anything behind it. Is a special wrench made for this bearing?—Carl Oldham, Chicago.

1—There is absolutely no remedy for loose ball bearings on a crankshaft—such as used on this Chalmers, the Lozier and 1909 models of the National—except complete renewal or taking the old ones out, having the races reground and larger balls put in. These bearings ought to stand at least 100,000 miles of car running, but when loose they will permit the shaft to sag, and this will put the clutch out of alignment. The inner races of these large ball bearings are fixed to the crankshaft, and it is necessary to remove the flywheel to take off the back bearing by first taking out the metallic wedges that are held in place by small screws. The flywheel must come out first. Then the straps that hold the outer race may be unbolted and when removed the crankshaft may be dropped, with the bearings thereon. It is easy to see that with the bearings so loose as described in your original question, there would be end and side play and the clutch could not be correctly lined up. The so-called adjusting ring is to prevent oil from escaping. When the bearings are tight and are placed as are the old ones, the shaft will be correctly lined.

2—It used to be the practice to key a flywheel on the end of the crankshaft, which generally was tapered. A locknut held the flywheel to the shaft. In some

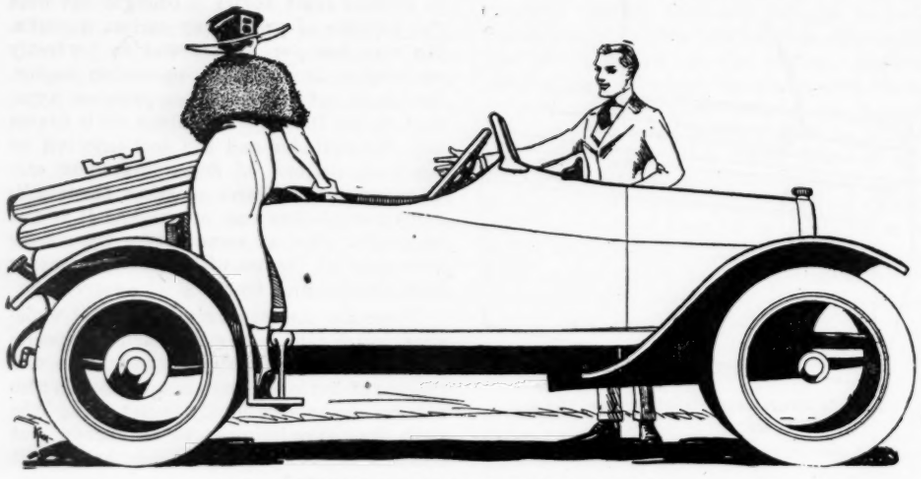


Fig. 7—Model 59 Overland rebuilt into speedster

instances, however, the flywheel was pressed on and a Woodruff key used. In either case it should be possible to remove it by the means tried. Try heating the hub of the flywheel while you have the puller rigged in place and a good tension set. Do not heat the shaft end any more than necessary, for it is desired to expand only the hub of the flywheel. Then tap sharply against the bar that is across the crankshaft end and keep setting the screws tighter. It may require some work, but this should cause it to yield.

Clicking Noise in Engine

Q—How can I remedy a clicking noise in the front end of the engine on my Monroe M 4? It seems to be in the front valve.—Reader, Washington, D. C.

Any one of three or four things may account for the noise mentioned, and it is a peculiar fact that these little noises develop in a motor car and sometimes cannot be found. As an illustration, the writer has a similar noise in his car that has existed for three years and is neither better nor worse, although not discovered and remedied. It has made no difference in the running of the car and most careful search by mechanics familiar with the car has failed to locate the noise, which resembles a loose tappet. Such a noise as has developed in your car may be located around the fan blades or it may be the belt lacing hitting the fan pulley.

If you find no difficulty here, try holding a screwdriver against the pushrods to see if wear in the guides has taken place. We, of course, are presuming you have made a careful adjustment of the clearance between the pushrods and the valve stems. By slowing the engine and going through a process of elimination, you ought to be able to discover the cause of the noise if it is from external sources.

Reboring an Engine

Q—When reboring an engine is it necessary to fit a larger carbureter, intake manifold and valves if the engine has been enlarged ⅛ in. by reboring?

2—Give addresses of firms in Toledo which do reboring?—W. X. F., Metamora, Ohio.

1—There is a big possibility that this will be necessary, for increasing the bore ⅛ in. means increasing the displacement considerably and with the now comparatively smaller manifold and carbureter refrigeration is apt to result by the faster passage of the gases through the carbureter passage and the intake pipe. This can be told better by experimenting, but at best it should have as short a manifold pipe as possible. Keeping to the same size carbureter will be apt to hold down the possible speed, whereas a larger one will increase the speed. You will have to look out for increased heat if you use the same size radiator.

2—MOTOR AGE has no list of concerns in Toledo that make a business of reboring cylinders, but there must be such places. So far as that is concerned, it will cost you no more to send the cylinders to Detroit or Cleveland than to Toledo and you will find several concerns in these two places that do this work.

Play in Crankshaft

Q—To take the end play out of a Ford crankshaft, which end should be bushed to get the most electricity out of the magneto?—Ralph M. Osborn, Brewster, Kan.

The lengthwise adjustment of the Ford crankshaft should be such as to give a $\frac{1}{32}$-in. gap between the stationary coil and the magnets.

Have Cylinders Rebored

Q—One cylinder is scored on my Buick D45. Would it be practical to have this one cylinder rebored and oversize piston put in or would this make the engine run unevenly?—O. B. Gallagher, San Antonio, Tex.

It would not prove satisfactory in any way; besides, it is probable that if one cylinder is in need of reboring and an oversize piston the others are at least nearing that condition. You would increase the displacement of that cylinder over the others, you would take in a slightly bigger charge of gas and make consequently a heavier impact on the piston, you would increase the weight of the piston, which, however, might be remedied by turning off some of the metal from the inside, and as you suggest, you would have an engine that would run unevenly because it would be out of balance. This would not be so noticeable at slow engine speeds, but it would readily tell at higher speeds. By all means have all the cylinders rebored and a complete set of new pistons put in.

Rebabbitting Connecting Rods

Q—What method is used in rebabbitting Ford connecting rods and cylinder blocks? Are they babbitted small and reamed to size? What kind of babbitt is used for this work? What kind for babbitted bronze bearings?—Carlos F. Ellis, Rochester, Minn.

It will not be an economical job to attempt to rebabbitt the bearings either on the connecting rods or crankshaft of a Ford car, because bearings can be obtained at such a small cost that their use would prove far more economical. Practically any Ford service station can furnish bearings, and any of the concerns that make a business of manufacturing die-cast bearings now make them especially for the Ford car. You undoubtedly would get more satisfaction by using die-cast bearings. MOTOR AGE has from time to time described and illustrated the method of fitting and scraping both the connecting rod and crankshaft bearings.

Trouble with Bicycle Engine

Q—I have a 2½-hp. one-cylinder Shaw bicycle engine, which has not been satisfactory. It has a mixing valve instead of a carbureter and the engine cannot be throttled down properly. This causes it to shake to pieces. Would a small carbureter such as is on the Smith wheel work on my Shaw satisfactorily?

2—The last time I ran it my connecting rod broke and also broke the piston. Would an aluminum piston be satisfactory? Where could I get one? I have been told that the engine gets too hot for aluminum pistons.

3—Would patented piston rings work satisfactorily? Where could I get these?—H. B. Stamps, Jr., Galbraith Springs, Tenn.

1—Yes.

2—Aluminum pistons hardly seem necessary here.

3—Yes, McQuay-Norris Mfg. Co., St. Louis, Mo., Burd High Compression Ring Co., Rockford, Ill.; Edward A. Cassidy Co., New York; Ever-Tyte Piston Ring Co., 1607 Kingsland street, St. Louis, Mo.; Gill Mfg. Co., 351-59 West Fifty-ninth street, Chicago; Inland Machine Works, 818 Mound street, St. Louis, Mo.; Keys Piston Ring Co., 3020 Olive street, St. Louis, Mo.

Cycle of an Engine

Q—Is a cycle engine the same as a rotary engine? Is the ordinary motor car engine a cycle engine?—G. A. Swanson, Craig, Neb.

No. The term "cycle engine" is ap-

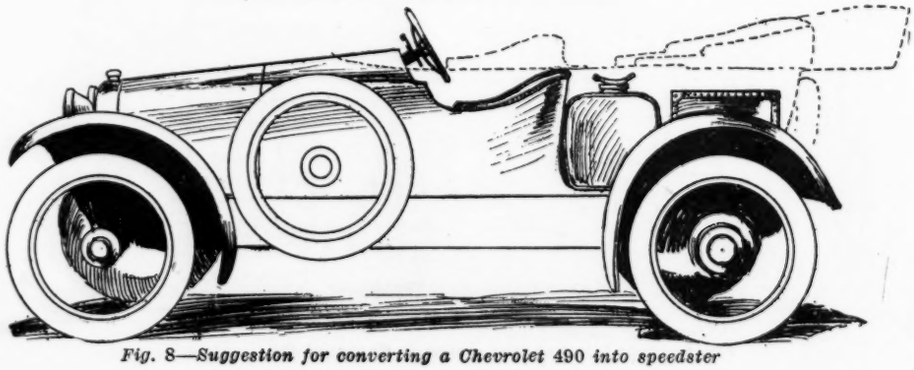


Fig. 8—Suggestion for converting a Chevrolet 490 into speedster

plied to the engine used in motorcycles. A rotary engine refers to an engine in which instead of moving back and forth in the cylinder at straight lines as in the ordinary motor car or motorcycle engine, the pistons more around in a circle or rotate. Sometimes this term is applied incorrectly to the rotating-cylinder engines such as the Gnome and LeRhone aviation engines.

You probably are confused by the terms "two-cycle" and "four-cycle" as applied to motor car engines. In this connection the word "cycle" refers to the series of events within the cylinders, that is, suction, compression, ignition-expansion and exhaust. This series of events is called the cycle of the engine and engines are called two-cycle or four-cycle depending on whether two or four complete up-and-down strokes of the piston are required to complete the cycle.

Long-Stroke Engines

Q—Why are motor car engines not made with such bore and stroke as 3 by 9, 4 by 8 or 5 by 10?—C. D. Meyer, Seattle, Wash.

It is true long-stroke engines have certain advantages, but to-day power is obtained by greater crankshaft speed and this cannot be accomplished in long-stroke engines as well as with the shorter strokes, because in the latter case the reciprocating parts are lighter. Using shorter strokes keeps down the size and weight of the engine, and the increased possible velocity of the crankshaft makes up for the longer application of power through a longer stroke. It is customary nowadays to make the stroke from a quarter to a third more than the bore, measured in inches.

Long stroke engines are not new, however. Probably the extreme was reached in the Sizarre-Naudan engine, made in France, where in a single-cylinder engine the bore was approximately a third of the stroke, which was something like 10 in. This single-cylinder engine was capable of driving a light car close to 100 m.p.h.

Rebuilding

Rebuilt Car Overheats

Q—We have just completed a speedster. In constructing this car we moved the engine back 13¼ in. from its original brackets, leaving the radiator where it belonged. After running this car we find that the engine seems to overheat. Is this because it is too far away from the radiator, or is it because this car is new? If so, how can this be remedied?

2—This engine has been rebored from 3⅝ in. to 0.0020 over 3¾ in. We also have installed larger valves, a Miller carbureter and a Bosch magneto with which we get plenty of speed. I am inclosing a sketch showing how we made connections on this Maxwell radiator—Gorman Motor Co., Joplin, Mo.

1—Your chief trouble comes in the fact that your radiator is much too far away from the fan, which ought to be within 1 or 1½ in. It is plain to be seen that the fan cannot draw the same volume of air placed so far back as if it were close, and it will be a difficult matter to remedy owing to the fact that there is nothing to drive the fan if moved forward. Possibly you can extend the fan shaft by making a new one, fixing the belt pulley to the back end of the shaft and providing some sort of a bracket to support the outward end of the shaft, with a ball bearing to permit it to rotate freely, as in Fig. 10.

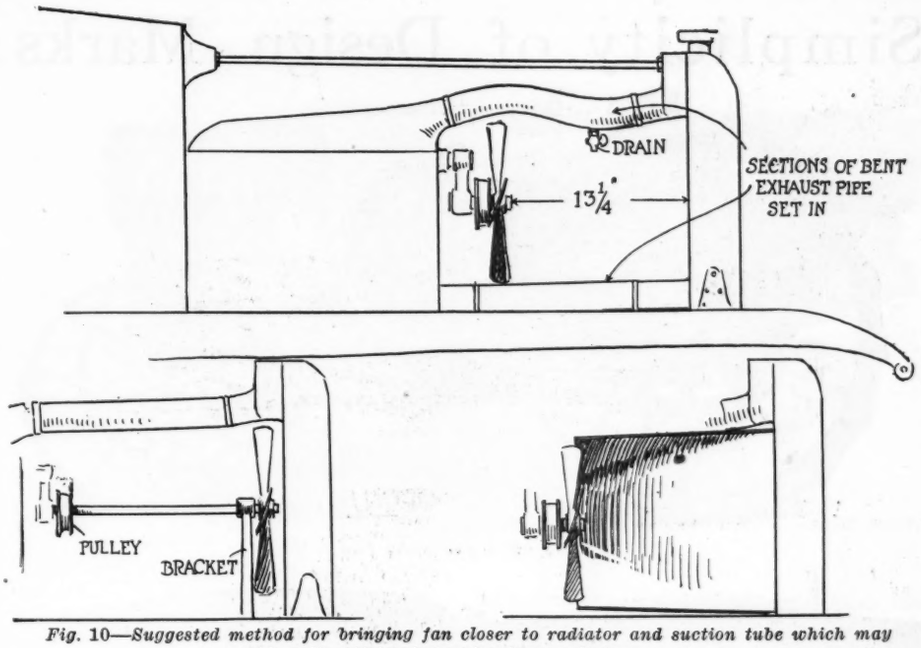


Fig. 10—Suggested method for bringing fan closer to radiator and suction tube which may aid cooling if fan is too far from radiator

Then it is possible that the drop in the outlet hose permits the water to pocket itself, although this should not be serious.

You have increased the piston displacement of each cylinder more than 13 cu. in., have set the engine back so the fan is inoperative and have put a pocket in the outlet hose.

We would suggest a higher radiator of somewhat increased capacity, to be set back as close to the fan as possible. The radiator with a thermosyphon system ought to be set so the inlet and outlet pipes are midway between the inlet and outlet pipes of the engine, and this can be done with a higher radiator.

The larger cylinders and larger valves permit a greater charge of gas to enter, and naturally there is more heat. This, added to the other troubles, naturally will cause the engine to heat.

It might be possible to build a blower pipe, or rather a suction pipe, so the fan can have direct pull of the air, as suggested here. This would mean making a funnel-shaped affair, with the large end toward the radiator and making the joints practically air-tight. The smaller end could just cover the fan blades, and by this method the fan would pull all the air through.

Wants to Increase Clearance

Q—My model 14 Saxon is still in good condition, but there is too little ground clearance. Could I put on 30-in. wheels instead of the 28-in.? Would this give me a standard tire size? Would a 3½-in. tire be too big? I believe the engine is able to carry the extra load. What difference would this make in steering? Would the fuel and tire upkeep be as economical as at present?

2—Will the Saxon hubs fit Ford wheels? If not, why not?—V. Steinborn, Chicago.

1—Yes, you can use 30-in. wheels and they will give you 1 in. more clearance, which should be sufficient for ordinary uses. The gear ratio will be increased slightly, but this ought not to make material difference except on a steep hill, and even then you would use a lower gear. We do not believe you will need 3½-in. tires, for the car is light and the load cannot be heavy. The Ford with five passengers uses only 3½-in. tires on the rear wheels. It would make no difference in the steering, but you must see that you have sufficient clearance between the tires and fenders, for the larger sizes will take up an additional inch of the space.

2—You can get rims, felloes and spokes with demountable rims that can be fitted to the Saxon hubs. These are made for the Ford but will fit the Saxon. The Firestone company or any large supply house on Michigan avenue carry them.

Chevrolet 490 Speedster

Q—Publish suggestion for converting a 1917 Chevrolet 490 into a speedster.—G. A. Tanguay, Quebec City, Quebec.

A suggestion for converting this model into a speedster is shown in Fig. 8.

Building Buick Speedster

Q—Publish suggestion for converting Buick C 24, 1915, into a speedster.—Everett Moody, Muncie, Ind.

This is shown in Fig. 9.

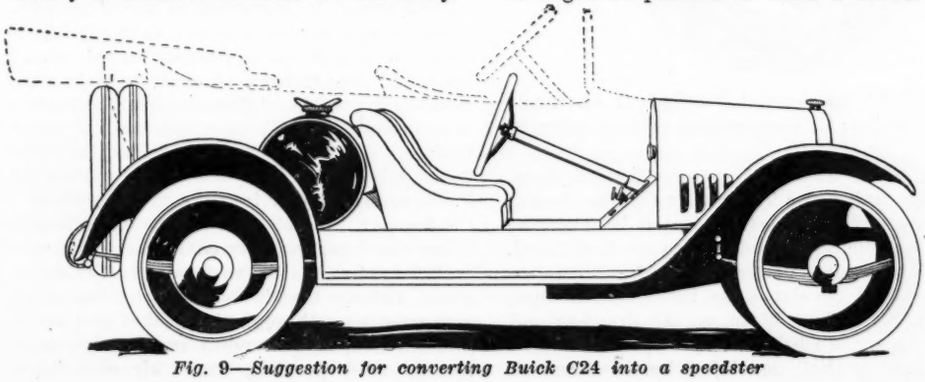
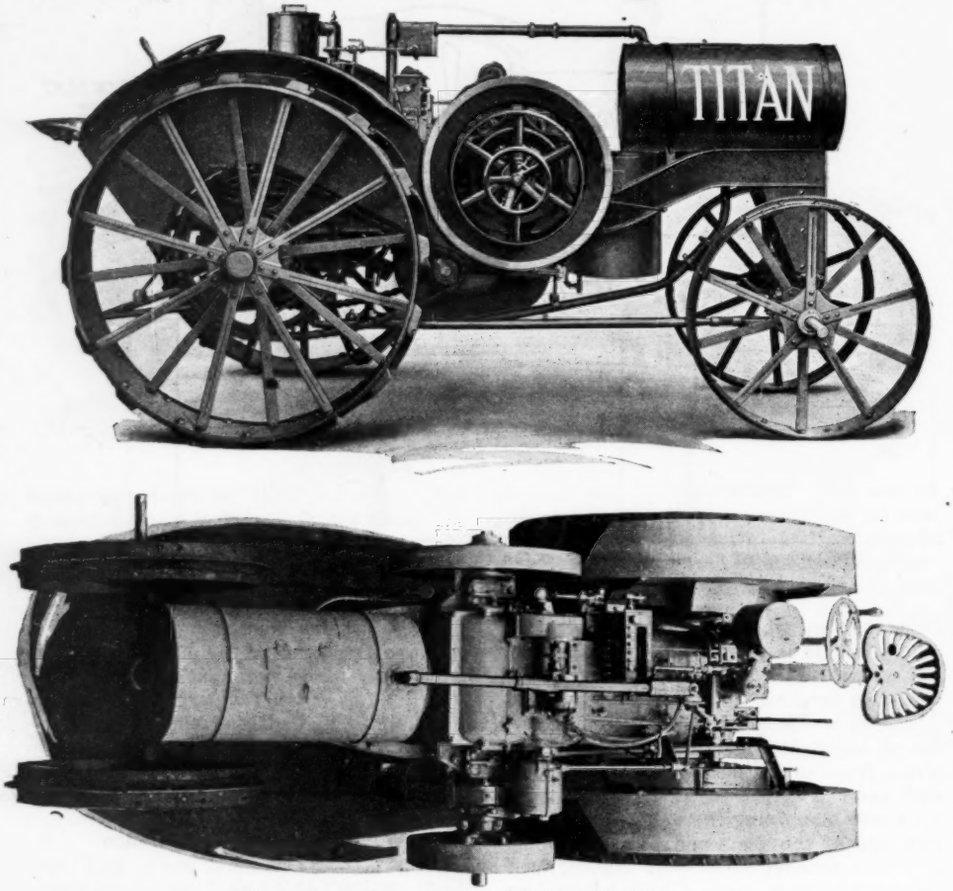


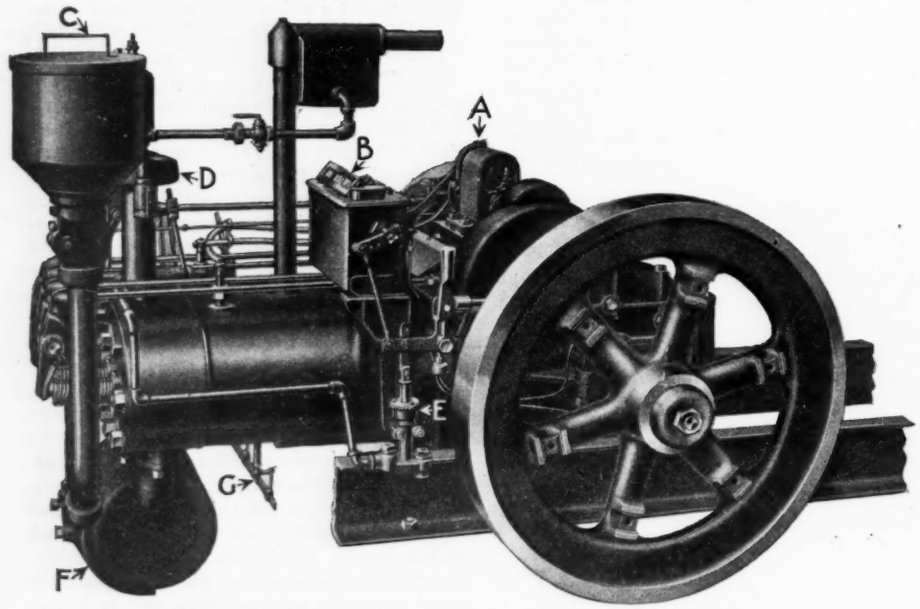
Fig. 9—Suggestion for converting Buick C24 into a speedster

Simplicity of Design Marks Titan Tractor

Four-Cylinder Utilizes Kerosene and Has Chain Drive



Side and airplane views of Titan 10-20 tractor



Engine of Titan—A, high-tension magneto; B, mechanical lubricator; C, air strainer; D, mixer; E, fuel pump; F, warm ar jacket; G, compression release valve

THE I. H. C. Titan 10-20 tractor is a kerosene-burning, four-wheel, chain-drive tractor with four-cylinder horizontal-type engine and characterized by unit construction, simplicity of design and reserve power.

The unit construction was adopted in the Titan to facilitate service on the farm. Practically all the small parts are attached to large parts and come off with them. This makes the Titan easy for the farmer to attend to himself and as it is otherwise accessible repair and service are facilitated.

The excess power which the Titan engine will develop is an important feature. While rated at 10 hp. on the drawbar and 20 hp. on the belt, the factory requirement is that it shall develop 5 hp. in excess of this conventional rating. This applies to both drawbar and belt, as the pulley take-off is direct from the crankshaft and the full power of the engine is transmitted to the pulley.

The simplicity of construction is illustrated. The side view of the tractor with the drive wheel removed shows the chain drive; the brake band, which is operated from the operator's seat by a foot pedal, the manner in which the motor car type of steering is inclosed, protecting it from dirt, the hitch of the tractor, which has both a lateral and vertical adjustment; and the bottom part of the gearcase.

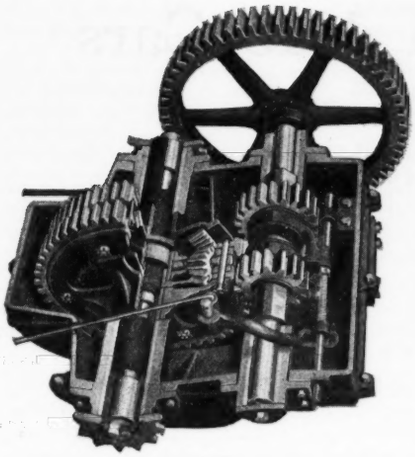
The gearset of the Titan is simple and effective. The transmission of power is so direct that few gears are required. This is a saving in friction loss. The gearset is tightly inclosed and runs in a bath of oil.

The Titan governor is a flyball throttling type, controlling the amount of fuel entering the cylinders and proportioning it to the load. Ignition is jump spark, current being obtained by a gear-driven magneto. No batteries are required. Lubrication is by automatic force-feed oiler with twelve feeds. The engine is water-cooled, circulation through cylinders, tank and tubular radiator being by a belt-driven rotary pump. The Titan has two speeds forward, 1.9 and 2.4 m.p.h., and a reverse speed of 1.9 m.p.h. The normal speed of the engine is 575 r.p.m. The total weight of the tractor, empty, is 8700 lb.

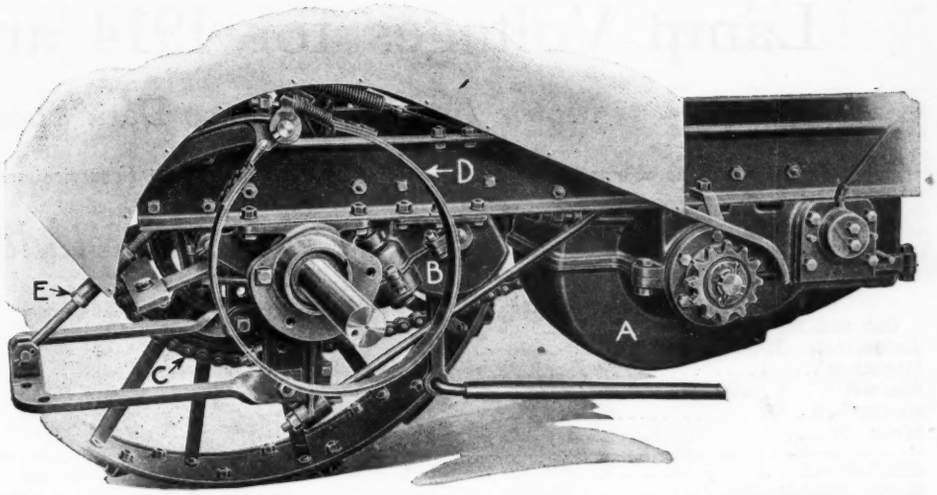
Mixer a Feature

The mixer is a feature of the Titan. It uses, without change of parts, gasoline, benzine, naphtha, kerosene and distillate down to 39 deg. Baume. The mixer is very simple to operate. On the left side, A, is a cup large enough to hold a small quantity of gasoline for starting. When the fuel switch lever, B, is in a vertical position, gasoline will be fed to the mixer from this cup. C is the needle valve, and in starting it is opened to a point indicated by a mark on the valve wheel.

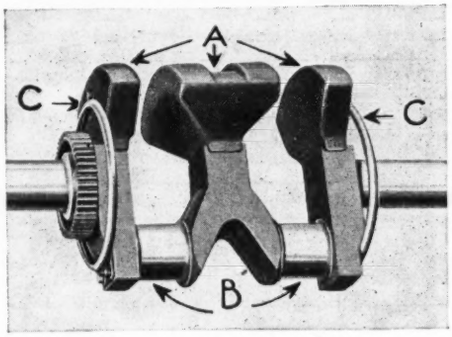
As soon as the engine is running well on gasoline and has become hot enough to operate satisfactorily on kerosene, the switch lever, B, is turned to a horizontal position and kerosene is fed to the mixer from the cup D. It is pumped to this cup from the supply tank so that there is no more fuel outside of the supply tank than is necessary for the proper operation of the tractor. Cold air enters the mixer at E, the supply being controlled by the damper, F. E opens directly into the air, but when the damper, F, is closed the pipe extending below the damper makes connection with a jacket around the exhaust pipe of the engine. The air that is drawn in by the engine must pass through this jacket and become heated, so that when running in extremely cold weather, warm air may be



Titan gearset



Side view with drive wheel removed—A, gearcase; B, steering gearcase; C, chain drive; D, brake band; E, adjustable hitch



Balanced crankshaft on the Titan tractor

used if necessary to assist in vaporizing the fuel. Under ordinary circumstances, this is not necessary.

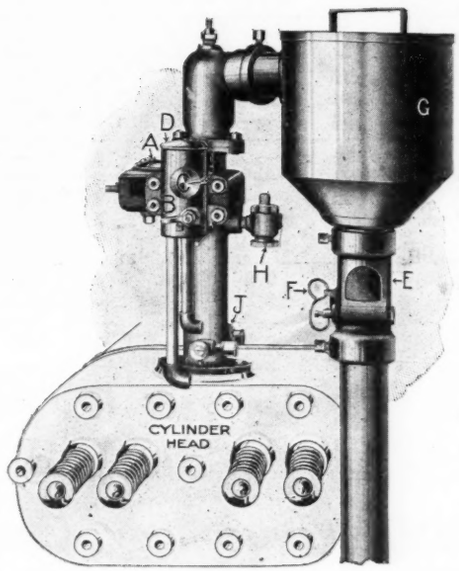
To prevent injury to the engine from dust and sand being drawn in with the air, an air strainer, G, is provided. This consists of a sheet metal chamber in which there is a layer of fine wool. All the air drawn in must pass through this wool so that the dust and dirt are strained out. The wool can be removed and washed when necessary.

LIBERTY ENGINE IGNITION

(*Continued from page* 23)

To take care of airplane requirements, a special light-weight battery was developed for the Liberty engine. These batteries are supplied by the Willard and Exide companies. They contain but very little electrolyte and may be turned upside down without harm. The battery is a four-cell type. The two types of battery vary slightly in detail but in general principle are quite similar. The battery is built within a double compartment, with the cells held in the lower part. The upper part of the receptacle forms an expansion chamber and at the same time helps to seal the battery. By this chamber the battery can be operated at various angles and positions without spilling the acid.

Not the least of the problems connected with the development of the Liberty aviation engine was the design of a special type of storage battery for the ignition. This battery had to be as light as possible and made so that the acid could not be spilt during the various maneuvers of the airplane. The Willard battery developed for this purpose weighs only 10 lb. 3 oz.



Fuel mixer on Titan 10-20 tractor

The batteries were supplied by the Willard Storage Co. and the Electric Storage Battery Co. and are assembled in a single unit container made of hard rubber. No individual jars are used in the manufacture of the battery. The plates are about 3 in. square and $\frac{3}{32}$ in. thick. Threaded rubber insulation is used between the plates, the ends of these insulators having thick ribs of hard rubber extending beyond the edges of the plates.

A thin, hard rubber baffle plate separates the part of the cell containing the plates from the large compartment into which the electrolyte is free to flow through small holes in the baffle when the battery is in an inverted position. This compartment is of sufficient size to hold all the acid without any leakage out of the vent hole, either when the battery is laid on its side or when it is in an inverted position. A deep, hard rubber cover and a specially designed vent plug complete the cell. Long, cylindrical posts of lead, burned to a lead insert in the top cover, serve to connect the plates with the top connectors and terminals of the battery.

The specific gravity of the electrolyte of this type of battery is read by tipping the battery on its side and taking the gravity by a hydrometer provided with a bent hard rubber tube. In flushing this battery each cell is filled with distilled water to a depth of 1 in. above the baffle plate. After several minutes the surplus water above the plate is removed with a hydrometer syringe. Charging is effected at a rate of one ampere. A discharge rate of 3 amp. can be maintained for 3 hr. at normal temperatures.

One of the features of this battery is the possibility of preparing it for overseas shipment in a "bone dry" condition. A battery prepared in this manner has never had any acid in the cells and can be kept in this condition for an indefinite period. When it is wanted for service the battery is filled with acid of a certain gravity and charged at a low rate until the specific gravity of the electrolyte and the battery voltage remain constant.

ENTER HEL-FI COMPANY

Belvidere, Ill., Jan. 3—The Hel-Fi Co. has taken over the entire business of the Motor Accessories Mfg. Co., formerly located at Marshalltown, Iowa, and will continue the manufacture and distribution of Hel-Fi spark plugs. C. C. Eldridge, formerly president of the Marshalltown concern, is president of the new organization. Heretofore distribution has been limited largely to western territory because of limited production capacity, but during the coming year the plugs will be offered to the trade throughout the United States and Canada and for export.

GREDAG UNDER CASSIDY WING

New York, Jan. 3—Negotiations have been completed whereby the Edward A. Cassidy Co. will act as the sales department for Gredag, a lubricant made by the Acheson Graphite Co. of Niagara Falls.

Gredag is a blending of the highest quality grease with 99.9 per cent pure Achesongraphite, which is manufactured by the special Acheson formulas and process. Thirty motor cars, trucks, motorcycles and tractors already have made Gredag their standard lubricant. A national sales campaign is to be conducted.

Lamp Voltages for 1914 and 1913 Cars

Motor Age Maintenance Data Sheet No. 20

One of a series of weekly pages of information valuable to service man and dealer—Save this page

1914 Cars—Concluded

Car and Model	Base contact	Headlights Volts	Headlights CP.	Headlights Amp.	Sidelights Volts	Sidelights CP.	Sidelights Amp.	Taillights Volts	Taillights CP.	Taillights Amp.	Dashlights Volts	Dashlights CP.	Dashlights Amp.
Locomobile—R-3 and M-4	Single	6-8	21	—	6-8	4	—	6-8	2	—	6-8	2	—
Marathon		—	16	—	—	—	—	—	2	—	—	4	—
Maxwell	Single	—	—	—	—	—	—	—	—	—	—	—	—
Mercer—35		7	24	—	7	4	—	3½	2	—	3½	2	—
Metz	Double	6	—	—	—	—	—	—	—	—	—	—	—
Mitchell—A	Double	6-8	15	2.5	6-8	2	.42	6-8	2	.42	6-8	2	.42
Moline-Knight—40	Single	6	16	—	6	4	—	6	2 or 4	—	6	2	—
Moline-Knight—50	Double	6	16	—	6	4	—	6	2 or 4	—	6	2	—
Moon—42	Single	—	—	—	—	—	—	—	—	—	—	—	—
National—6	Double	—	—	—	—	—	—	—	—	—	—	—	—
Oakland—36	Single	7	12	—	—	4	—	7	4	—	7	2	—
Oldsmobile—54	Single	—	—	—	—	—	—	—	—	—	—	—	—
Overland—79	Single	6	16	—	6	4	—	3	2	—	3	2	—
Packard—1-38 and	Double	7	24	—	7½	4	—	7½	4	—	4	4	—
Packard—3-48	Double	7	24	—	7½	4	—	7	4	—	4	4	—
Packard—2-38	Double	7	24	—	7	6	—	7	2	—	4	4	—
Packard—4-48	Double	7	24	—	7	6	—	7	2	—	6	2	—
Paige—4-36	Single	6-8	15	2½	6-8	4	.75	6-8	2	.4	6-8	2	.4
Peerless		6	16	—	6	3	—	6	2	—	—	—	—
Pierce-Arrow—All	Single	6-7	21	—	6-7	4	—	6-7	2	—	6-7	4	—
Premier	Double	6-8	15	2.5	6-8	4	.84	6-8	2	.42	6-8	2	.42
Reo—R and S	Double	6-8	15	3	—	—	—	3-4	2	1	3-4	2	1
Speedwell	Single	—	—	—	—	—	—	—	—	—	—	—	—
Stearns-Knight—All	Single	6	15	2.5	6	4	.84	6	2	.42	6	2	.42
Studebaker		7	15	2.5	—	—	—	7	2	.42	7	2	.42
Stutz—E	Double	6-8	18	8	6-8	21	2.5	6-8	2	.42	—	—	—
Westcott—O-30	Single	6	20	—	6	6	—	6	2	—	6	2	—
White—All	Double	18	21	1.25	18	4	.26	18	4	.26	18	4	.26
Winton—20	Double	6-8	15	2-5	6-8	15	2-5	6-8	4	.34	6-8	4	.34

1913 Passenger Cars

Apperson	Double	—	—	—	—	—	—	—	—	—	—	—	—
Auburn	Double	—	—	—	—	—	—	—	—	—	—	—	—
Cadillac	Double	7	16	—	7	4	—	3.5	2	—	3.5	2	—
Case—N and O	Double	6-8	18	2½	6-8	4	.84	6-8	2	.42	6-8	2	.42
Chalmers—All	Double	6	15	—	6	3	—	6	1½	—	6	2	—
Chandler	Double	6-8	16	—	6-8	4	—	6-8	2	—	6-8	2	—
Davis—All	Single	6-8	18	—	6-8	4	—	6-8	2	—	6-8	2	—
Dorris—I	Single	7	15	2.5	7	4	.84	7	4	.84	7	2	.42
Ford—T	Double	6-8	15	—	Oil	—	—	Oil	—	—	—	—	—
Franklin—All	Double	7	21	—	7	4	—	7	2	—	7	2	—
Haynes—23-24 and 25	Double	6-8	16	—	6-8	5	—	6-8	2	—	6-8	2	—
Hudson—37	Double	8	4	—	6	16	—	3	1	—	3	2	—
Hudson—54	Double	6	16	—	8	4	—	3	2	—	3	2	—
Inter-state—45	Double	6	21	—	6	4	—	6	4	—	6	2	—
Jackson	Single	—	—	—	—	—	—	—	—	—	—	—	—
Jeffery—83	Double	6-8	15	10	6-8	4	10	6-8	2	10	—	—	—
KlineKar	Double	—	—	—	—	—	—	—	—	—	—	—	—
KisselKar—All	Double	6	21	—	6	6	—	6	3	—	6	3	—
Lexington—6-C	Double	6	18	—	6	2	—	6	4	—	6	4	—
Locomobile—All	Double	6-8	21	—	6-8	4	—	6-8	2	—	6-8	2	—
Marmon	Double	—	—	—	—	—	—	—	—	—	—	—	—
Maxwell	Single	—	—	—	—	—	—	—	—	—	—	—	—
Mercer—35		7	24	—	7	4	—	3½	2	—	3½	2	—
Mitchell	Double	6-8	15	2.5	6-8	2	.42	6-8	2	.42	6-8	2	.42
Moline-Knight—50	Double	6	16	—	6	4	—	6	2 or 4	—	6	2	—
Oakland—42	Double	6	12	—	—	4	—	6	2	—	6	2	—
Overland—69 and 71	Double	6	16	—	6	6	—	6	2	—	6	2	—
Packard—2-48	Double	7	24	—	7½	4	—	7½	4	—	4	4	—
Paige—4-36	Single	6-8	15	2½	6-8	4	.75	6-8	2	.4	6-8	2	.4
Peerless		6	16	—	6	3	—	6	2	—	—	—	—

*Double contact. †Single contact. ‡Dimmer.

Pierce-Arrow—All	Single	6–7	21	—	6–7	4	—	6–7	2	—	6–7	4	—
Premier	Double	6–8	15	2.5	6–8	4	.84	6–8	2	.42	6–8	2	.42
Reo—R and S	Double	—	—	—	3–4	2	—	—	—	—	—	—	—
Scripps-Booth	Double	6	—	—	6	—	—	6	—	—	—	—	—
Stearns—All	Double	6	15	2.5	6	4	.84	6	2	.42	6	2	.42
Studebaker		7	15	2.5	7	4	.84	7	2	.42	7	2	.42
Stutz—B	Double	6–8	18	8	6–8	21	2.5	6–8	2	.42	—	—	—
Westcott—40	Double	12	20	—	12	6	—	12	2	—	12	2	—
Westcott—50	Double	6	20	—	6	6	—	16	2	—	6	2	—
White—All	Double	6	21	3.5	6	4	1	6	4	1	6	4	—
Winton—17-D	Double	6–8	15	2–5	6–8	15	2–5	6–8	4	.34	6–8	4	.34

1912 Passenger Cars

Cadillac	Double	6.4	16	—	6.3	4	—	3.2	2	—	3.2	2	—
Davis—40	Double	6–8	18	—	6–8	4	—	6–8	2	—	6–8	2	—
Ford—T	Double	6–8	15	2	Oil	—	—	Oil	—	—	—	—	—
Franklin—All	Double	7	21	—	7	4	—	7	2	—	7	2	—
Haynes—22	Double	6–8	16	—	6–8	5	—	6–8	2	—	6–8	2	—
Hupmobile—32-H		Acetylene											
Inter-State—All	Double	6	21	—	6	4	—	6	4	—	6	2	—
Locomobile—All	Double	6–8	21	—	6–8	3	—	6–8	2	—	—	—	—
Moline—40	Double	6	16	—	6	4	—	6	2 or 4	—	6	2	—
Packard—1-48	Double	—	—	—	7	4	—	7	4	—	—	—	—
Packard—30 and 18		Acetylene			6*	4	—	6*	4	—	—	—	—
Pierce-Arrow—All		6–7	—	—	6–7	—	—	6–7	—	—	6–7	—	—
Premier		Acetylene											
Stearns—All	Double	6	15	2.5	6	4	.84	6	2	.42	6	2	.42
Studebaker		—	—	—	—	—	—	—	—	—	—	—	—
Stutz—A		Acetylene											
White—All	Double	6	21	3 5	6	4	1	6	4	1	6	4	1
Winton—17-C	Double	6–8	15	2–5	6–8	15	2–5	6–8	4	.34	6–8	4	.34

*Double contact. †Single contact. ‡Dimmers.

NEXT WEEK—Serial Numbers

Things You Should Know About Materials

Aids to Handling Motor Car Metals

Brass castings and parts of bar and sheet enter largely into the electrical equipment and fittings of all cars. The chief points responsible for its wide use are its rust-resisting nature, its malleability, a good conductor of electricity and ease of working. Bar brass and most brass castings can be machined at double the rates of speed of any metals so far enumerated. Besides working easily, it takes a high finish, which was formerly a strong point in the use of it for car trimmings. Sheet brass can be bent and formed into almost any desired shape, doing the work cold. If heated or heated and plunged in water, brass becomes very soft and remains so permanently. This is an aid in some classes of repair work, but it must be remembered that the original strength cannot be put back by ordinary methods. Brass is hot short, that is, it is brittle when red hot.

Aluminum

Aluminum is a material like brass and bronze in that it has a distinctive color which tells the mechanic what it is the minute any coating that may have been applied is scraped deep enough to uncover the metal. Everyone knows that aluminum is very light in weight and has a light gray, almost white, color. Crankcases and gearboxes are major parts that are cast of it. At present prices it is the most expensive of the metals in common use and has been superseded for many purposes by cheaper materials. Aluminum is soft and therefore can be machined at high speeds. Its nature is somewhat like cast iron. Fine threads are cut in it with difficulty because it crumbles so easily. Aluminum may be bent slightly when cold but at a risk, so it is classed as a brittle metal. Strength almost equal to steel at a third of the weight has been the characteristic which has brought aluminum into extensive use, and a resistance to road shocks even with its brittleness. As a bearing or wearing material aluminum is not satisfactory, the aluminum pistons of to-day being alloys in which other substances play an important part.

Die Castings

White metal castings have a wide use in motor car work. Carbureters, magneto parts, speedometers, pistons and various other parts chiefly in the accessory field owe their low cost to the process of casting white metal in metal molds called dies, which turn out intricate and accurate parts which require no machining to be ready for use. For ordinary uses zinc is the base of such castings. For special work other ingredients are added to impart the desired qualities. As cast zinc is brittle so are the products of this process. They will stand but little bending before breaking. Though, broadly speaking, die castings are used for structural rather than bearing and wearing purposes, bearing for minor shafts are made from this metal. The die-cast liners for connecting rod big ends and the aluminum pistons are of special composition, different from the multitude of castings, including gears, that are displayed as shown. White metal pieces machine easily, but, owing to their nature, when threads are tapped in them, the U. S. standard is used instead of the finer S. A. E. The same applies to aluminum and accounts for the coarse threads on one end of the crankcase studs.

Copper

Copper has come into prominence with electric starting and lighting. Both the motor and generator commutators are composed of copper bars insulated by mica strips. Copper is very soft and crushes and bends easily. In commutators the bars are well supported, but in order not to tear them badly, a fine-pointed tool and a fine feed must be used in the lathe when turning. With these a cut light in depth and a relatively high speed are used. Copper may be filed lightly. A heavy stroke with a file is apt to dig and tear. As a polisher, sandpaper should be used whenever obtainable in preference to emery paper. The cut of the machine should leave a surface so smooth that no dressing with a file is required other than enough to polish or burnish.

Service Equipment
Time Savers of the Shop

Boe Grease Pump

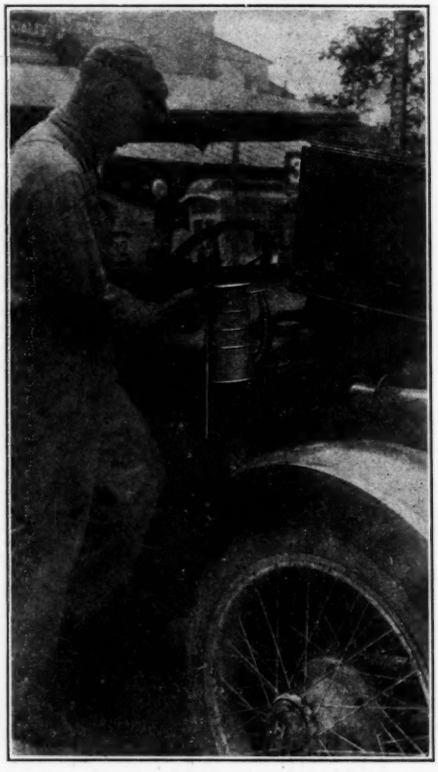
A NEW grease pump has been put out by H. M. Boe & Co., Minneapolis, Minn. This is a crank-operated, geared-action model which dispenses and measures grease or oil by pound or pint simply by the operator's turning a crank. Measuring is governed by a 5-in. meter dial plainly readable through a large opening in the cover. The entire cover can be removed instantly for refilling. About 24 oz. is dispensed to a pump stroke. The pump is furnished in three sizes for $25, $40 and $50 respectively.

Acetylene Generators

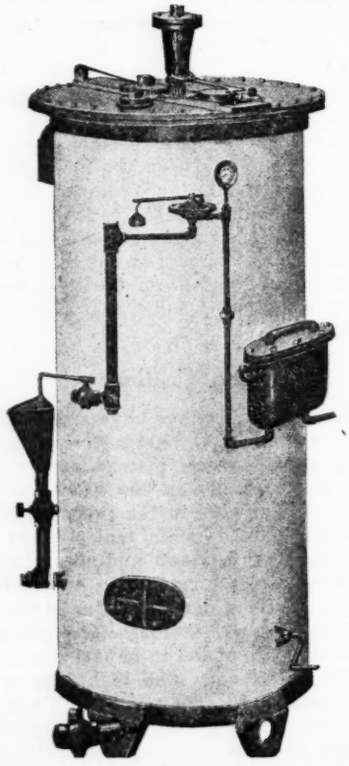
Acetylene, the fuel gas used in welding, is obtained in tanks or in a dissolved or compressed state, or it is generated automatically as used at the torch, in a special acetylene generator. The Henderson-Willis Welding & Cutting Co., St. Louis, Mo., which manufactures flame welding and cutting apparatus exclusively, makes two generators, the Atlasta and the Standard. The Atlasta generator is made in 25- and 50-lb. sizes. That is, it will take 25 and 50 lb. of carbide at a charge. It will only feed the small carbide, ¼ by 1/12 in., which is guaranteed to produce 4¼ cu. ft. of acetylene to a pound of carbide. The Standard model is furnished in 50-, 100-, 200- and 300-lb. sizes. It feeds the large size carbide, ¼ by ⅜ in., which yields 15 per cent more gas than the small size carbide. The generator is automatic and is operated by independent motor feed. The motor is substantially built and equipped with double safety locking devices. All seams and connections are welded. Acetylene made from this generator is said to be pure and costs not more than $1 a 100 cu. ft. The Atlasta generates 4¼ cu. ft. of gas to a pound of carbide, while the Standard generates 4½-5 cu. ft. The normal output is a cubic foot of gas an hour to a pound of carbide. The Atlasta will operate continuously for 4¼ hr., and the Standard, for 4¾ hr.

Service Liquid Measure

A combination measure, funnel and strainer, especially adapted for the handling of lubricating oil in connection with motor cars, airplanes, trucks and tractors, is put out by Frank Carroll & Co., San Antonio, Tex. A flexible nozzle does away entirely with the use of a funnel, allowing oil to be put with ease into the most inaccessible places. A valve in the bottom of the measure controls the flow of the oil through the nozzle. This valve is operated by a thumb lever which is located just above the handle. The measures are made in two sizes, 1 gal. and ½ gal. The gallon can is provided with a hinged cover which prevents any dust or other foreign substance from settling on the oil or in any way coming in contact with it. A strainer also covers the bottom of the measure. When not in use the nozzle is held in place by a clamp near the top of the measure. To discharge you release the nozzle, place it in the filler plug, press the thumb lever and the oil discharges through the nozzle. When empty, or you have sufficient oil, release the thumb lever and replace the nozzle.



Service liquid measure in use



Standard acetylene generator

Permatite Patches

A permanent repair for inner tubes is made by the Permatite Mfg. Co., Minneapolis, Minn. This takes the place of vulcanizing. Repairs are made very quickly with it. To use, clean the place to be treated with gasoline or emery paper and apply a good coat of cement to the tube, letting it dry well. Then cut off a piece of Perma-Tite large enough to make the repair and remove the cloth from the rubber side of the patch. Do not cement the patch, as this is unnecessary. Apply it to tube, pressing well into place. The tube can be replaced in the casing immediately, pumped hard and the car driven at high speed. The patches can be used in emergency on casings. Prices are: 40 sq. in., one tube Perma-Tite cement, emery paper, 50 cents; 85 sq. in., tube of cement and emery paper, $1; 100 sq. in., one can of repair dough for casings and a can of Perma-Tite cement, $1.75.

Cylinder Reboring Machine

The cylinder reboring machine made by the Storm Mfg. Co., Thompson, Iowa, was designed and developed by practical men with years of experience in machine and repairshop practice. No. 101 will rebore practically all makes of engines, including the Ford, and other small cylinders of all kinds. Each cylinder is rebored and finished to the desired oversize with one operation, making it possible to rebore all cylinders to exactly the same size without making several adjustments for each cylinder. The four cylinders are made of high-grade steel and universally adjusted by a single cutter adjuster. There are seven lead, or pilot, rings, ranging from 3¾ to 4½ in. No. 104 is a machine put out at a lower cost for Ford repairmen and garagemen of small means. It is the same as the parts for Fords in the standard machine, using the same cutter head, cutters, cutter adjuster, left feed bar, feed plate, etc. No. 105 equipment, added to No. 104, makes a complete standard machine. It consists of a right feed bar, feed bushing, large guide block, centering ring, clamp, bolts and six lead rings. Small and large attachments are provided for the standard machine, with small or long cutters, etc. The machines are equipped for operating by hand but also can be operated by power.

The Accessory Corner

New Fitments for the Car

Marvel Spring Shackles

THE spring shackle made by the Marvel Machinery Co., Minneapolis, Minn., is built on the toggle principle, embodying in its construction a compression coil spring mounted between the two arms comprising the device, which replaces the shackle at the rear end of the front spring. The device has the effect of lengthening the front springs to more than double their original length, allowing the wheels to pass over road obstructions without communicating any of the shock to the body of the car, its mechanism or passengers, it is claimed.

Safety Signal

The safety device made by the Auto Indicator Co., 209-217 Ottawa street, N. W., Grand Rapids, Mich., is a combination of four signals in one. It is a mechanically-revolving signal, successively illuminated and exposed to view. The foot-brake mechanism controls the safety signal, and a hand control also is available, attached to the driver's seat. A rod leads to the rear of the car, to which is fastened the signal proper. The automatic foot control is attached to the brake rod, which, in turn, communicates with the rod of the signal device. The price is $15, complete.

Rapid Change Wheels

A simple change in the hubs of the Ford car gives a set of rapid-change demountable wheels, says the Rapid Change Wheel Co., Grand Rapids, Mich. The outfit consists of fittings for the four hubs, spare wheel, wheel carrier and a wrench. The same wheels and hubs are used. The threaded sleeve is placed over the hub, bolted on with six studs, making six solid bearings to hold the wheel in place. The flanged bushing makes a solid bearing to the ends and sides of spokes. Unscrewing one nut makes the rapid change possible. The wheel bracket included with the outfit carries the wheel and tire on the side or rear of car, holding the wheel firmly by the center and preventing warping or chafing.

Mapson Valve Lifter

The valve lifter made by the Mapson Mfg. Co., 1025 Fourth street, San Diego, Cal., is operated by one man on any car or truck with T or L-head engine with little effort required to compress the stiffest valve spring, it is said. The action is all above the cylinder heads, and no side strain is imposed as the jaws move in a perpendicular line with the point which rests on the center of the valve head. The device is made of soft steel and has no moving parts. The spring is held securely at the desired point by an automatically locking ratchet, and the operator's hands are free to remove the retaining pin or washer. The ratchet, 1, locks automatically and securely holds the valve spring in the desired position. The ratchet release is shown at 2 in the illustration. As action is vertical, 3, no side strain is imposed on the valve stem. The jaws, 4, are adjustable to fit any size of spring retainer. Adjustment is by a simple set screw. The device sells for $5.

Four-in-one-safety device

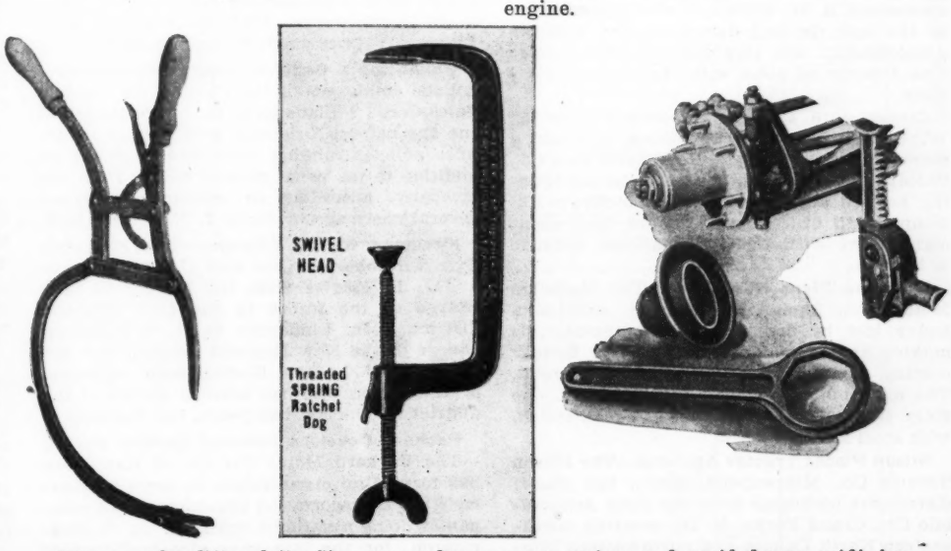
Marvel spring shackle, left, and Hel-Fi spark plug

Stevenson Valve Remover

The Stevenson quick-action valve remover, made by the Hedden Place Machine Co., East Orange, N. J., is instantly released by pressing the catch, and the screw feature makes it possible to get exactly the opening desired. In using it, place the remover in position over the valve with the pronged end beneath the valve spring. Releasing the catch allows the pivoted button at the end of the screw to rest on the valve head. Then using the wing nut at the end of the screw, a few turns compress the spring so the key can be lifted out. A touch on the thumb catch, and the remover instantly is disengaged and the valve can be removed for examination. The device sells for $3.

Hel-Fi Spark Plug

The Hel-Fi spark plug, which is made by the Hel-Fi Co., Belvidere, Ill., is featured by four parallel electrodes. All parts are interchangeable, and the insulation is strengthened by a dead air space between the shell and the porcelain. Expansion is taken up by copper asbestos gaskets, spring washers and a spring tongue gland. The tip of the terminal cap can be used as a gage for adjusting the electrodes. The makers advance as arguments for the plug that the magnetic field created by the position of the four parallel electrodes induce a spark of four times the strength possible to produce by the use of ordinary plugs. Attention also is called to the fact that the electrodes are non-housed and extend into the combustion chamber of the engine.



Mapson valve lifter, left; Stevenson valve remover, center; and rapid-change outfit for wheels, right

Among the Makers and Dealers

Short Trade Notes

AVERY Opens Columbus Branch — The Avery Co. has opened a new branch house at Columbus, Ohio. The manager is F. E. Kitchen, formerly with the Indianapolis branch.

Garford Adds Another Department—The Garford Motor Truck Co., Lima, Ohio, has added a department of branch supervision, with T. B. Fogg as branch supervisor.

Meers with Gibson Co. Now—I. B. Meers, until recently Pacific Coast manager of the King Motor Car Co. of Detroit, has been made foreign sales manager for the Gibson Co., with offices in New York.

Ranier New District Managers—T. L. Briggs has been appointed district manager for the Ranier Motor Corp., covering the Middle West. H. J. Ayers has been appointed district manager in New York and the New England states.

Hall Opens Up Tire Business—Jerry Hall, formerly general manager of the Mechanical Belt Co., has resigned and opened up a wholesale and retail tire and accessory business at St. Joseph, Mo. The new concern is called the Jerry Hall Tire Co.

USL Promotes Donop—A. W. Donop, who has been connected with the railway sales department of the U. S. Light & Heat Corp., Niagara Falls, N. Y., has been promoted to be district manager and engineer in charge of the San Francisco branch.

Goodyear Manager in Australasia—A. G. Cameron, manager of the Goodyear Tire & Rubber Co. branch in St. Louis, Mo., has been promoted to manager of the trade in Australasia, which will necessitate his spending several months each year in the southern seas.

Goodyear Special Tire School—In response to the demand for information concerning methods of repairing the large pneumatic truck tires the Goodyear Tire & Rubber Co., Akron, Ohio, is adding to its tire repair school a special course in the repair of these big tires.

Bowman is Garford Sales Manager—J. F. Bowman has been appointed sales manager of the Garford Motor Truck Co., Lima, Ohio, succeeding S. M. Williams, who takes charge of the new Garford department of highway development. Mr. Bowman for several years was director of sales with the Federal company.

Clarke with Chicago Pneumatic Tool—H. W. Clarke has been appointed advertising manager for the Chicago Pneumatic Tool Co., Chicago. Mr. Clarke was with the advertising service department of the McGraw-Hill company in Chicago and before that spent eight years with the Westinghouse Electric & Mfg. Co.

Maibohm Plans New Plant—The Maibohm Motors Co., Racine, Wis., which suffered a heavy loss by fire in its plant recently, is making arrangements to build a new factory costing about $100,000 without equipment. The main building will be 80 by 600 feet, one story high, of steel and brick construction, with steel sash.

Nilson Places Tractor Agencies—The Nilson Tractor Co., Minneapolis, Minn., has placed distributer contracts with the Sims Automobile Co., Grand Forks, N. D., covering northeastern North Dakota and northwestern Minnesota territory, and the Larimer & Burget Bridge Co., Memphis, Tenn., covering western Tennessee, northern Mississippi and eastern Arkansas.

THE BANK GOES TO THE SOLDIER—As the soldier in France cannot come to a bank over here this New York bank goes to the soldier with a portable bank, as shown. This is one of ten banks produced by Selden for abroad

Miller is Nelson G. S. M.—Glenn B. Miller has been appointed general sales manager of the Nelson Motor Truck Co., Saginaw, Mich.

Evans to Represent Gillette Rubber—John F. Evans, Evans Motor Sales Co., National distributer in Detroit, has been appointed representative of the Gillette Rubber Co. He will be general manager of the Detroit Gillette branch which will be styled the Gillette Rubber Co. of Michigan.

Avery Co. Promotes Lunenschloss—Leo Lunenschloss, for six years manager of the principal Wisconsin sales office of the Avery Co., Peoria, Ill., in Madison, Wis., has been promoted to the position of foreign sales agent, with headquarters for the time being at the Peoria works. He is succeeded by R. B. Lyman, Watertown, S. D., as manager.

Philadelphia Cadillac Insures Employees—All the employees of the Cadillac Automobile Sales Corp., Philadelphia, Pa., were surprised the day before Christmas with gifts of insurance policies ranging from $500 to $3,000, in addition to the usual gifts of money from the company, according to custom established several years ago by Percy L. Neel, president.

Firestone Makes Changes—The Firestone Tire & Rubber Co. has sent C. B. Lindeman and J. E. Mayles from the factory to take charge of the forces in the New England district. Mr. Lindeman is to have direct charge of the New England district, and Mr. Mayles will be the Boston zone manager. J. T. Clinton, who has been in charge of the district for the last two years, has resigned.

Packard Develops National Service Bureau—The Packard Motor Car Co. of New York has formed an organization to serve particularly the transportation requirements of companies doing a national business. A. C. Harrington, for the last year vice-president of distribution for the New York company, will have charge of the new organization, and associated with him are F. H. Pietsch, manager of truck distribution for the Packard Motor Car Co. of Chicago, and James T. Adams, until recently manager of the Washington office of the company.

Michigan City Foundry to Start—The Michigan City Foundry & Machine Co. will break ground in Chicago early in the spring for a foundry which will make a specialty of castings. Albert F. Fort is the moving spirit behind the venture and associated with him will be W. K. Greenebaum, as secretary of the company.

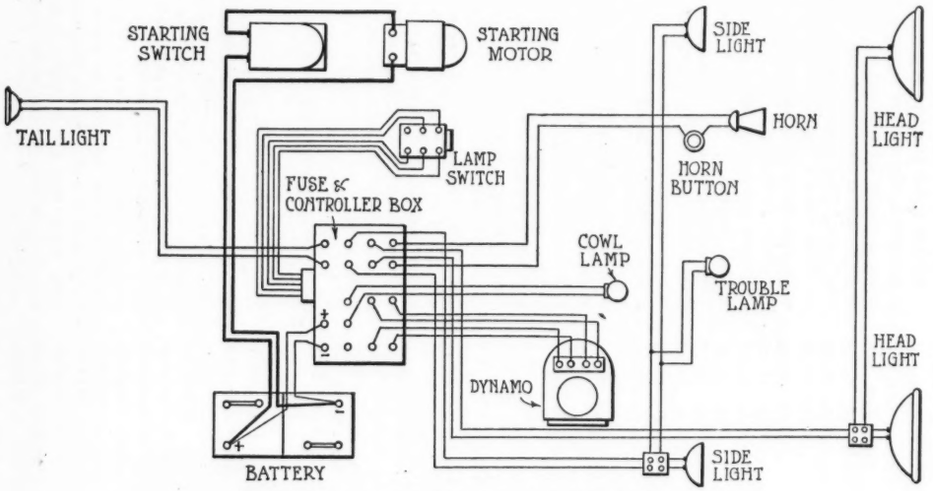
Washington Dealers Hold Meeting—The annual convention of the Buick dealers of the Inland Empire was held at the Davenport Hotel, Spokane, Wash., recently. The dealers held two sessions this year, one of an educational nature, at which the agents made a trade of sales ideas, and the other session was given over to the discussion of trade opinions. In the evening the dealers were the guests of the Eldridge Buick Co.

Kissel Plans Dealer House Organ—The Kissel Motor Car Co., Hartford, Wis., which for a year or more issued a weekly paper for the benefit of the hundreds of its employees in the military and naval service, is converting the publication into a house organ for its dealer organization. The first issue of the new paper was to be Jan. 7 and each month thereafter. The name, "The Kisselgraph," will be retained.

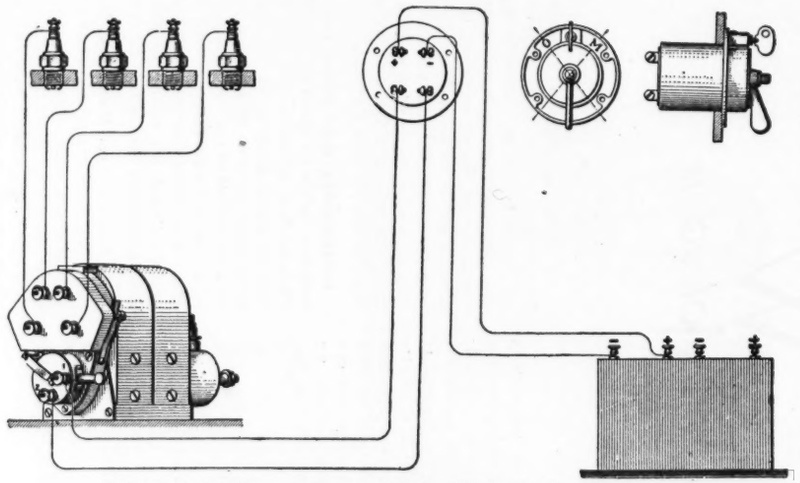
Comet Gets Foreign Orders—The Comet Automobile Co., Decatur, Ill., which has been engaged in the manufacture of motor trucks for some months, has received an order for seventy-five 2-ton trucks from Switzerland and one for twenty-five 2-ton trucks from Italy. The Comet plant is resuming quantity production and is in receipt of an unexpectedly large number of orders from foreign countries. All Government contracts were completed prior to the first of the year.

Motor Age Wiring Diagram Chart No. 10

Mitchell Models



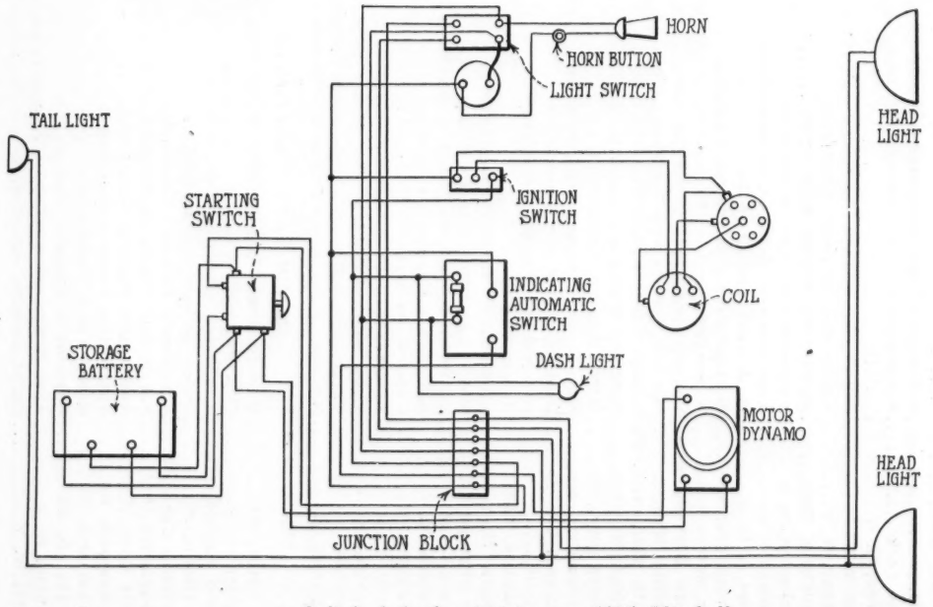
Esterline system used on **1913** *Mitchell*



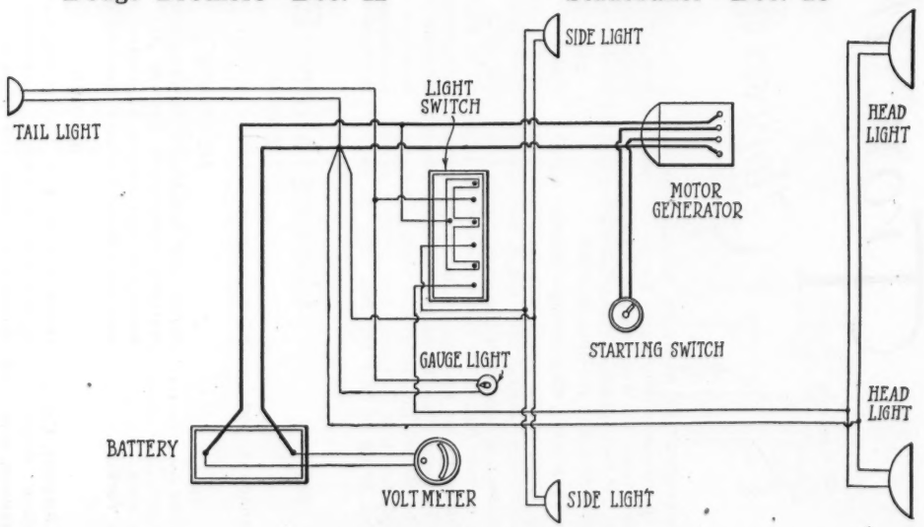
Splitdorf-Apelco system on **1913** *Mitchell six-cylinder car*

Next Week—Ford

Alter—Nov. 14	Hudson—Dec. 5
Buick—Nov. 21	Oakland—Jan. 2
Cadillac—Dec. 19	Overland—Nov. 7-14
Chevrolet—Nov. 28	Scripps-Booth—Dec. 26
Dodge Brothers—Dec. 12	Studebaker—Dec. 26



Splitdorf-Apelco ignition on **1915** *Mitchell*



North East system on **1914** *Marmon*

From the Four Winds

Glimpses at the World of Motordom

WASHINGTON Registers 126,380—The following are the figures for motor vehicle registrations in Washington: 1918 registrations, 126,380; revenue, $868,917; 1917 registrations, 97,704; and revenue, $510,099.

Pennsylvania Registering 150,000 Cars—Fully 12,000 of the applicants for licenses in Pennsylvania during 1918 asked for special numbers, and the list of those requesting tags with certain figures or combinations for 1919 promises to be as numerous. Applications now indicate that the number of tags issued will be 150,000 for the entire year. Cash received for new licenses has broken every record, being to date $420,860. For the same period in 1917 cash for licenses amounted to $296,627. The pneumatic-tired vehicle licenses issued thus far for 1919 number 32,951 and solid-tired 5111.

Club Adds 1565 Members in Year—The Automobile Club of Western Washington has elected the following new officers: R. M. Dyer, president; J. P. Leavitt, first vice-president; J. T. Harrah, second vice-president; C. F. Nolte, third vice-president; I. C. Rowland, secretary; J. W. Maxwell, treasurer, and Douglas A. Shelor, manager. A total of 3444 members have been handled through the organization in the twelve-month period, an increase in membership of 1565. During the year the organization marked 1324 miles of road in western Washington.

To Examine Jitneys That Ask License—There are about 3000 jitneys and public service vehicles in Connecticut and in order that the public may be safeguarded the commissioner of motor vehicles, Robins B. Stoeleel, is going to have inspectors examine all cars for which licenses are desired. Many of the cars now in service are on the verge of the junk pile, but the owners persist in plying the trade, it is claimed.

Philadelphia May Have Aerial Route—An airplane route to Atlantic City is planned by Philadelphia citizens, the cost of transportation to passengers to be $50 one way, or, if a passenger decides to make a round trip, $25 will be deducted on the return. Construction of a hangar and factory with a 25-ft. beach front has been started near the inlet. It is expected that the company will begin carrying passengers soon after Easter.

No Leniency for Motorists—The Massachusetts highway commission has sent a notification to every chief of police in the state to the effect that any motorist operating a car on and after Jan. 1 next with this year's number plates should be either stopped from using his car or arrested, as it is illegal to use 1918 numbers in 1919. The commission has served notice on motorists that it has plenty of numbers on hand and there is no excuse this year to be without 1919 numbers by Jan. 1.

Switch Keys Did the Work—It remained for a Hartford, Conn., garageman to clear up at least a material portion of the mystery that has clouded thefts in the residential section of that city. The past month an average of two or three cars a night worried the police. He went out sleuthing nights and finally rounded up four youngsters, all of them less than eighteen years old, who were equipped with switch keys to fit various makes of good cars. They confessed to stealing the keys from cars. The escapades usually consisted of taking a car from one part of the residential section and leaving it in another.

Garagemen Would Halt Private Buses—Some of the men doing a garage and rental business in Massachusetts cities and towns have a real grievance and they are planning to find a remedy in organization against it. For example, while they have invested several thousand dollars in garages and cars they now find that owners of private cars taking out persons for trips at so much per ride. In summer the owners of trucks take parties to shore and country resorts by putting in a few chairs or boards, and they make a good thing from this all the season. Yet they are all breaking the law, for no one is allowed to drive for hire without a chauffeur's license. But as the men who are trespassing upon the work of the garage men are neighbors and friends they do not like to take action. So a suggestion has been made that a state-wide organization be formed or either the men interested join some one of the organizations in Massachusetts and request the officials of these bodies to take action, first in the courts and then before the highway commission. It would not be possible to have the highway commission take action through its inspectors, for it has not enough of them, but that body would co-operate when complaints were made to it.

Coming Motor Events

RACES

Indianapolis, Ind.	500-Mile Sweepstakes	May 31

MEETINGS

Chicago	Motor and Accessory Manufacturers' Association	Jan. 29
Chicago	National Automobile Dealers' Association	Jan. 28-29
New York	Society of Automotive Engineers	Feb. 4-6
New York	American Road Builders' Association	Feb. 25-28

SHOWS

Los Angeles, Cal.	Motor Car Dealers' Association, automotive	Jan. 11-18
Spokane, Wash.	Automobile Chamber of Commerce	Jan. 15-18
Milwaukee, Wis.	Milwaukee Automobile Dealers, Inc.	Jan. 24-30
Fargo, N. D.	Implement Dealers' Association, tractors	Jan. 22-24
Chicago	Automobile Trade Association, cars	Jan. 25-Feb. 1
Toledo, Ohio		Jan. 27-Feb. 1
Chicago	Automobile Trade Association, trucks	Feb. 3-6
New York	Automobile Dealers' Association, cars	Feb. 1-8
Fargo, N. D.		Feb. 5-8
New York	Automobile Dealers' Association, trucks	Feb. 10-15
Albany, N. Y.	Automobile Dealers' Association	Feb. 15-22
Cleveland, Ohio	Automobile Trades Association	Feb. 15-22
Rochester, N. Y.	Automobile Dealers' Association	Feb. 15-22
Louisville, Ky.	Auto Dealers' Association, automotive	Feb. 17-22
Newark, N. J.	N. J. Auto Exhibition Co.	Feb. 15-22
Minneapolis, Minn.	Northwestern Automotive Exposition	Feb. 15-22
Des Moines, Iowa	Automobile Dealers' Association, automotive	Feb. 17-22
South Bethlehem, Pa.	Lehigh Valley Auto Shows Co., cars	Feb. 17-24
Wichita, Kan.	Wichita Tractor and Thresher Club	Feb. 18-22
South Bethlehem, Pa.	Lehigh Valley Auto Shows Co., trucks	Feb. 24-27
Springfield, Mass.	Cars and trucks	Feb. 24-March 1
Kansas City, Mo.	Motor Dealers' Association, cars	Feb. 24-March 1
Kansas City, Mo.	Kansas City Tractor Club, tractors	Feb. 24-March 1
Portland, Ore.	Dealers' Motor Car Association	Feb. 24-March 1
Detroit	Automobile Dealers' Association	March 1-8
Columbus, Ohio	Automobile Show Co.	March 3-8
Buffalo, N. Y.	Automobile Dealers' Association	March 3-8
San Francisco, Cal.	Motor Car Dealers' Association	March 1-10
Omaha, Neb.	Automobile Trade Association, automotive	March 10-15
Syracuse, N. Y.	Automobile Dealers' Association	March 10-15
St. Joseph, Mo.	Dealers' Association	March 12-15
Boston, Mass.	Automobile Dealers' Association, cars	March 15-22
Brooklyn, N. Y.	Motor Vehicle Dealers' Association, cars	March 22-29
Brooklyn, N. Y.	Motor Vehicle Dealers' Association, trucks	April 1-5
Montreal, Canada	National Motor Show of Eastern Canada	April 5-12

SHOW DATES INDEFINITE

St. Louis, Mo.	Manufacturers' and Dealers' Association	About March 1
Bridgeport, Conn.	City Battalion	Not Decided
Grand Rapids, Mich.	Automobile Business Association	February
Harrisburg, Pa.	Motor Dealers' Association	March
Hartford, Conn.	Automobile Dealers' Association	Not Decided
Indianapolis, Ind.	Automobile Trade Association	Not Decided
Little Rock, Ark.	Automobile Dealers' Association	Not Decided
Philadelphia, Pa.	Automobile Trade Association	March
Philadelphia, Pa.	Motor Truck Association	March
Pittsburgh, Pa.	Automobile Dealers' Association	March
Trenton, N. J.	Auto Trade Association	March 22-29
Utica, N. Y.	Motor Dealers' Association	March